




Education on making pace leaf extract hand sanitizer to improve junior high school students' knowledge

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ARTICLE INFO	ABSTRACT
<p>Article history Received: 2024-05-03 Revised: 2024-08-20 Accepted: 2024-09-09 Published: 2024-12-05</p> <p>Keywords Adiwiyata Program Hand Sanitizer Pace Leaf Extract</p>	<p><i>In the wake of the ongoing global pandemic, maintaining hand hygiene has become paramount to prevent disease transmission. Hand sanitizer serves as a practical solution in situations where access to water and soap is limited, especially in school environments. This article outlines a training program designed for junior high school students participating in the Adiwiyata program, aimed at enhancing their understanding of hand hygiene and empowering them to independently produce hand sanitizer using readily available ingredients. The training program incorporates various steps, including a pre-test to gauge students' initial knowledge, educational sessions highlighting the importance of cleanliness and proper hand hygiene practices, hands-on practice sessions for students to craft hand sanitizer, and post-training evaluation to assess knowledge retention and practical skills. Results indicate a significant improvement in students' knowledge and practical abilities in hand sanitizer production, as well as a heightened awareness of the importance of hand hygiene in disease prevention. By equipping students with the skills to create their own hand sanitizer, the training not only promotes individual health but also aligns with the objectives of the Adiwiyata program by reducing reliance on commercial products containing potentially harmful chemicals and fostering a cleaner, healthier school environment.</i></p>
<p>Kata Kunci Program Adiwiyata Handsanitizer Ekstrak Daun Pace</p>	<p>Edukasi Pembuatan Hand Sanitizer dari Ekstrak Daun Mengkudu untuk Meningkatkan Pengetahuan Siswa Sekolah Menengah Pertama. Di tengah pandemi global yang sedang berlangsung, menjaga kebersihan tangan menjadi hal yang sangat penting untuk mencegah penularan penyakit. <i>Hand sanitizer</i> berfungsi sebagai solusi praktis dalam situasi akses terhadap air dan sabun terbatas, terutama di lingkungan sekolah. Artikel ini menguraikan program pelatihan yang dirancang untuk siswa sekolah menengah pertama yang berpartisipasi dalam program Adiwiyata, yang bertujuan untuk meningkatkan pemahaman mereka tentang kebersihan tangan dan memberdayakan mereka untuk secara mandiri memproduksi pembersih tangan dengan menggunakan bahan-bahan yang tersedia. Program pelatihan mencakup berbagai langkah, termasuk tes awal untuk mengukur pengetahuan awal siswa, sesi pendidikan yang menyoroti pentingnya kebersihan dan praktik kebersihan tangan yang benar, sesi praktik langsung bagi siswa untuk membuat pembersih tangan, dan evaluasi pasca pelatihan untuk menilai retensi pengetahuan dan keterampilan praktis. Hasilnya menunjukkan peningkatan yang signifikan dalam pengetahuan dan kemampuan praktis siswa dalam produksi pembersih tangan, serta meningkatnya kesadaran akan pentingnya kebersihan tangan dalam pencegahan penyakit. Dengan membekali siswa dengan keterampilan membuat pembersih tangan sendiri, pelatihan ini tidak hanya meningkatkan kesehatan individu tetapi juga sejalan dengan tujuan program Adiwiyata dengan mengurangi ketergantungan pada produk komersial yang mengandung bahan kimia yang berpotensi membahayakan dan menciptakan lingkungan sekolah yang lebih bersih dan sehat</p> <p style="text-align: right;">Copyright © 2024, Riyanta et al This is an open access article under the CC-BY-SA license</p> <div style="text-align: right;">  </div>

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INTRODUCTION

Indonesia has launched 17 SDGs goals for a developed Indonesia (Morita et al., 2020). Two of these SDGs goals are in accordance with the activities carried out primarily in terms of the quality of education and good health and well-being. On the other hand, in realizing quality education, one of the activities is environmental activities. Environmental impacts that have occurred such as the previous two years, namely the covid-19 virus pandemic (Loh et al., 2022). This service activity is aimed at providing education and skills in improving the quality of education and health awareness. In the current era of the global pandemic, maintaining cleanliness is more important than ever. One effective step in maintaining health is washing your hands regularly. However, it is not always possible to wash your hands with water and soap all the time, especially in school environments. Therefore, using hand sanitizer is a practical solution for maintaining hand hygiene (Prakobdi et al., 2023). Hand sanitizer, with its alcohol content which effectively kills germs, is a good alternative when washing hands with water and soap is not possible. When used correctly, hand sanitizers can reduce the risk of disease transmission, especially in situations where hand washing facilities are limited (Pan et al., 2024). Hand sanitizer is usually easier to use because it doesn't require water (Suhono et al., 2021). This makes it very practical for use in places where there is no access to clean water or hand washing facilities. Hand sanitizers that contain alcohol in high enough concentrations have the ability to kill various kinds of germs, including viruses, bacteria and fungi (Aodah et al., 2021). This makes it effective for cleaning the hands of germs that may cause disease. Using hand sanitizer only takes a few seconds, while washing hands with soap takes longer because of the rinsing process with water. This makes it possible to clean hands more quickly in situations that require instant cleanliness (Golin et al., 2020).

Allergies to the ingredients used in hand sanitizers can be a problem for some people (Himabindu et al., 2022). Alcohol, such as isopropyl alcohol or ethanol, is an active ingredient commonly used in hand sanitizers to kill germs and viruses. Some people may have an allergic reaction to alcohol or other additives in hand sanitizer. Apart from that, the fragrance ingredients that are often added to hand sanitizers can also cause allergic reactions in some individuals. Allergic reactions can vary from skin rashes, itching, swelling, to more serious allergic reactions. For those who have a history of allergies or sensitivities to certain ingredients, it is important to check product labels and avoid hand sanitizers that contain ingredients that can trigger allergic reactions. If a person experiences an allergic reaction after using hand sanitizer, it is recommended to stop using it and consult a healthcare professional (Qadri et al., 2022).

Health is a very valuable asset for every individual, especially in the context of school education (Hopkins & Rippon, 2015). In order to support the Adiwiyata program which aims to create a clean, green, beautiful and healthy school environment, it is important for junior high school students to understand and implement good health practices. Adiwiyata School is a school program based on sustainable environmental development (Desfandi et al., 2017; A. B. Riyanta et al., 2023). These schools are encouraged to improve the quality of education by incorporating the processing of environmental products and promoting the preservation and utilization of the environment as part of their environmental development efforts. One important aspect in maintaining health is the habit of washing hands with hand sanitizer (Avila et al., 2023).

SMP Negeri 3 Tegal, a public junior high school, is one of the Adiwiyata Schools that organizes environmental development. One of the activities is to utilize plants within the school environment. To support this effort and provide educational opportunities, training sessions is needed to teach students how to process these plants (A. B. Riyanta et al., 2023). The plants can be used in managing the environment, one of which is for virus prevention by making a hand sanitizer. Hand sanitizer is a practical solution for cleaning hands when water and soap are not available. In order to improve junior high school students' understanding and skills regarding making hand sanitizers, we are holding this training as part of efforts to support the Adiwiyata program. Through this training, it is hoped that students will be able to understand the importance of hand hygiene and be able to make hand sanitizer independently using ingredients that are easily found around them (Daverey & Dutta, 2021).

This training not only aims to increase awareness of the importance of hand hygiene, but also to empower students to play an active role in maintaining their own health and the school environment. Thus, it is hoped that this training will be the first step for students to adopt a healthy and sustainable lifestyle. Through this training, we hope to create a school environment that is healthier, more productive and cares for the surrounding environment. Hopefully this training will provide real benefits for students and the school environment as a whole (Wang et al., 2024).

METHOD

SMP (Junior High School) 3 Tegal as an Adiwiyata School has launched an improvement in the quality of education and environmental development which requires resources and knowledge about making hand sanitizers. For this reason, the service team was invited to provide education and training in making hand sanitizers. The service team, together with the team of teachers and the principal, designed training activities to be held. The agreed activities were then carried out in the science laboratory at SMP Negeri 3 Tegal with 30 students attending.

This article aims to provide a training guide for junior high school students in SMP 3 Tegal involved in the Adiwiyata program in making hand sanitizers. These steps not only help raise awareness of the importance of personal health, but also help protect the environment by reducing the use of products containing harmful chemicals. Training in making hand sanitizers is a good step in the Adiwiyata program to strengthen awareness of health and the environment. By teaching

students to make their own hand sanitizer, they not only gain practical skills, but also help reduce the environmental footprint of commercial products containing harmful chemicals.

The steps for this training activity in making hand sanitizers include several stages: preparation, implementation, pre-evaluation, training, and post-evaluation.

Preparation

The service team consisted of Dr. Aldi Budi Riyanta, Wilda Amananti, S.Pd, M.Si and Istiqomah Dwi Andari, S.ST., M.Kes, along with six students from the Pharmacy Study Program. The team initially prepared for the training by making hand sanitizers in the pharmacy laboratory. Subsequently, they coordinated with the school to arrange for the resource persons' invitation to SMP Negeri 3 Tegal.

Implementation

This stage began with an introduction about Adiwiyata School program, Indonesia's SDGs, and environmental development. Following this, training is carried out with students made into 6 groups, each of which is given tools and materials for making hand sanitizers from pace leaves.

Pre-evaluation

This phase includes pretest activities to assess students' initial knowledge of hand sanitizers.

Training

At this stage, the service team trains students in making hand sanitizers. The training is divided into three sessions: (1) education on the importance of cleanliness; (2) education on the importance of washing hands and using hand sanitizers to prevent disease transmission; and (3) direct practice by students. Students are given the opportunity to make hand sanitizers under the direct guidance of the PKM team, as well as learn the correct way to use it.

Post-evaluation

After the practice session, a discussion session was held to explore students' understanding on the process of making hand sanitizers. Evaluations were also carried out to assess students' understanding and ensure they could correctly make hand sanitizers. There were 10 questions provided, relating to knowledge about Adiwiyata, the benefits of pace leaves, the use of hand sanitizers, and the process of making hand sanitizers from pace leaves. These questions were given before and after the training activity. The differences in the pre- and post-training results served as indicators of the activity's success, demonstrating that participants had gained the knowledge and skills to produce hand sanitizers using pace leaves.

RESULTS AND DISCUSSION

Implementation

This service activity was conducted in the Science Laboratory of SMP 3 Tegal, involving 30 participants from grades X and XI. The event took place on April 29, 2024, from 8:00 AM to 12:00 PM. The activity began with the introduction of the service team, followed by remarks from the teaching staff and the principal. The program continued with the provision of materials, followed by hands-on training. Participants were divided into six groups, with each group consisting of five students.

Pretest Activities

Administering a pretest before the training on making hand sanitizer from pace leaf extract is an effective way to evaluate students' understanding before the training session (Boyce & Schaffner, 2021). In this program, the training session began with a pretest to measure participants' baseline knowledge. Questions covered topics ranging from Adiwiyata Schools to the process of making hand sanitizer, aligning with the training's theme. The pretest results showed an average score of 46, highlighting a general lack of awareness among participants about Adiwiyata Schools, personal hygiene, and the use of pace leaves for making hand sanitizers. Notably, pace leaves have been shown to possess antibacterial properties effective against bacteria such as *Staphylococcus aureus*, *Escherichia coli*, *Salmonella*, *Staphylococcus epidermidis*, and *Propionibacterium acnes* (Nasution et al., 2024). These bacteria cause various diseases, ranging from digestive disorders to skin problems. From the pretest evaluation, it was found that the students' most common mistakes included errors in identifying the required ingredients and outlining the correct manufacturing process of hand sanitizers.

Providing Educational Material About the Importance of Cleanliness

Environmental education is an important aspect of character education for students in Indonesia. The Adiwiyata Program is one of the programs launched by the Ministry of Environment and Forestry (KLHK) which aims to integrate environmental education into daily school activities. One effort that can be made to support this program is through training in making hand sanitizers for junior high school students (Figuroa et al., 2023). The community team provided

material about the importance of washing hands and using hand sanitizers in preventing disease transmission (Figure 2). Washing your hands is a simple but very effective step in preventing the spread of disease. Hands are one of the biggest means of spreading germs and bacteria because they often come into contact with various surfaces. By washing our hands regularly, especially before and after doing certain activities such as eating, using the toilet, or caring for sick people, we can remove germs that stick to our hands (Abebe et al., 2023).

The community team provides knowledge about correct hand washing techniques. It is important to teach people the correct technique for washing their hands. This includes using clean water and soap, rubbing the palms of the hands, the backs of the hands, between the fingers, and under the nails for at least 20 seconds, and then rinsing with clean water. When water and soap are not available, hand sanitizers can be an effective alternative. Hand sanitizer contains alcohol which can kill germs, including viruses. However, it is important to ensure that hand sanitizer contains at least 60% alcohol for maximum effectiveness. Hand sanitizer should be used when washing hands with water and soap is not possible, for example when traveling or in a public place. However, washing hands with water and soap remains a better option when possible. Even though hand sanitizer can kill many germs, not all germs and dirt can be removed with hand sanitizer. Therefore, washing hands with water and soap remains the main step in maintaining cleanliness. It is important to remember that keeping your hands clean is not a one-time act but should become a consistent habit. Continuous education and reminders are needed to ensure that people continue to keep their hands clean (Ziemba et al., 2018).



Figure 2. Educational activities about the importance of cleanliness

Direct Practice by Students on Making Pace Leaf Extract Hand Sanitizer

In this community activity, students carry out extraction practice (Figure 3). Students practice extraction using the boiling method. Extraction of pace leaves using water as a solvent is included in the water solvent extraction category. In this process, water-soluble substances will be pulled out of the pace leaves and dissolved in the solvent. By boiling the pace leaves with water until half remains, the water-soluble substances will concentrate in the solvent, forming an extract from the pace leaves (Noyes et al., 2022).



Figure 3. Students' hands-on practice in extracting pace leaves

This extraction practice has several advantages for students. First, students will gain direct experience in carrying out the extraction process, allowing them to understand the theoretical concepts studied in class better. Second, by doing extraction practice, students can improve their practical skills in using laboratory equipment, handling chemicals, and following procedures correctly. Lastly, through practice, students will gain a deeper understanding of various extraction techniques, including their advantages and disadvantages. They can also understand the factors that influence extraction results. By facing real situations in the extraction process, students will develop their analytical skills in evaluating results and drawing conclusions from the experiments carried out. Many extraction practices are carried out in groups or teams. This helps students to improve their teamwork skills, including the ability to communicate, collaborate, and divide tasks. Additionally, these practices serve as valuable preparation for careers in science and technology. as extraction is a commonly used technique in a variety of industries, such as pharmaceutical, chemical, and biotechnology. Practical activities often make students more enthusiastic about learning the material, because they provide real-world experience and spark their interest in the subject. Students will be faced with challenges and problems that they must solve during the extraction process, which will help them develop important problem-solving skills in science and everyday life (Noyes et al., 2022).

The materials prepared in making hand sanitizer include pace leaf extract, propylene glycol and ethanol. with the following formulation shown in Table 1.

Table 1. Materials and formulation for making hand sanitizers

No.	Material	Concentration
1.	Pace leaf extract	30%
2.	Propylene glycol	20%
3.	Ethanol	Add 100

Students make hand sanitizers according to the formulation in Table 1 (Figure 4). The function of each ingredient in making hand sanitizer includes Pace Leaf Extract, which is an ingredient in hand sanitizer, which functions as an active ingredient because it contains flavonoids which function as antimicrobials (Abubakar et al., 2024). Pace leaf extract can have antibacterial and antifungal effects, which can increase the effectiveness of hand sanitizer in killing germs (Cabral et al., 2023). Propylene Glycol is a substance used as a thickening or binding agent in hand sanitizers (Morales, 2018). Propylene glycol helps retain skin moisture after using hand sanitizer, thereby reducing the possibility of irritation or dryness of the skin (Pasquini et al., 2020). Ethanol is the main ingredient in hand sanitizer which acts as an antimicrobial agent (Chojnacki et al., 2021). Ethanol has strong antimicrobial properties and is effective in killing most bacteria, viruses and fungi (Malvar et al., 2024). These three ingredients work together to create a hand sanitizer that is effective in cleaning and protecting hands from germs. The final product of the hand sanitizer is shown in Figure 5.



Figure 4. Students practice making hand sanitizer

Post-evaluation

Hand sanitizer serves as a disinfectant to reduce and prevent the spread of bacteria and germs on the hands. Unsanitary hands contain germs that can be transmitted to various parts of the body through touch (Dastider et al., 2020). When these germs come into contact with certain areas, such as the nose or mouth, they can cause infections or be carried through internal organ systems (Choi et al., 2021). For instance, touching the nose can introduce pathogens into the nasal passages, potentially leading to respiratory infections. The spread of the COVID-19 virus is an example, as it can be transmitted through hand contact, reaching the nasal passages and ultimately attacking the lungs (Sosnowski, 2021).



Figure 5. Hand sanitizer product from students' practice

The evaluation of community activities focuses on understanding knowledge about hand sanitizers, including their ingredients, preparation process, and the importance of their use. The hand sanitizer consists of three components, namely pace leaf extract, propylene glycol and 70% alcohol. Pace leaf extract serves as an active ingredient, functioning as an antibacterial agent to help prevent diseases caused by bacteria. Pace leaves are rich in flavonoids, which have been shown to inhibit bacterial activity effectively. As active compounds, flavonoids can disrupt bacterial membrane functions, hinder biofilm formation, inhibit efflux pumps, and suppress bacterial virulence factors, ultimately leading to bacterial lysis (Song et al., 2022). Evaluation of knowledge level is carried out by giving a post-test. This post-test can provide an overview of students' level of knowledge after carrying out community activities (Ginting & Sembiring, 2020). The post-test results showed that the students' average score increased by 78. This result shows that there is an increase of 70% from the pretest score (Figure 6). The results indicate that this service activity was successful, as evidenced by the improvement in knowledge scores following the post-test. The post-test results also reflect the students' practical skills, demonstrating their ability to effectively apply the knowledge gained during the training. Students showed a solid understanding of the process and successfully acquired practical skills in making hand sanitizers. Similar training activities have been carried out a lot, such as the training conducted by Riyanta et al (2020) on making eco-enzymes and foot sanitizer for high school students showing success with pre-test and post-test.

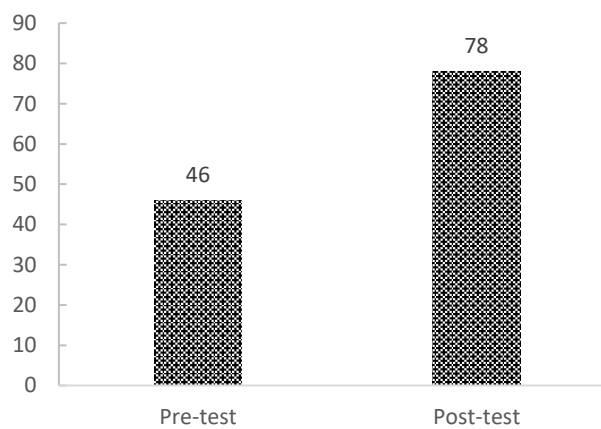


Figure 6. Result from pretest and post test

In this program, students' understanding of safety in using chemicals was increased. Students understand the importance of hand hygiene in maintaining health and preventing the spread of disease. There was also an increase in students' ability to explain the process of making hand sanitizer. Students were encouraged to ask questions about the training, including any challenges they faced while making hand sanitizers from pace leaves (Andini, 2019; Andini et al., 2024a; Andini et al., 2024b; Andini & Prastiyowati, 2021). Participants were also asked to explain key aspects of the process, such as the ingredients used, the preparation steps, and to evaluate the results of their work. Students who answer correctly were given door prizes such as book packages, pencils or other school supplies. The outcomes of the service activity indicate that participants gained a solid understanding of the training. The success of the program was measured using the results of the pretest, posttest, and Q&A sessions as key indicators.

CONCLUSION

The Adiwiyata School launched by SMP (Junior High School) 3 Tegal has synergy with government efforts to achieve the Sustainable Development Goals (SDGs), particularly in improving education and health quality. This training activity was successful, resulting in a 70% improvement in knowledge among the participants. This result shows that service

activities can support school initiatives such as Adiwiyata while contributing to the SDGs. This service activity is expected to be implemented regularly and expanded to include other schools.

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