**FINAL REPORT OF LIVING LAB PROJECT**

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| Teacher | LA THI THUY MAI |
| Type | Curriculum (Regular Classes) or **Extra-Curriculum Activities** |
| School | Chiem Hoa High School |
| Grade | 10th |
| Number of Students | 38 |
| Number of Groups | 4 |
| Semester Starts on | September 5th |
| Semester Ends on | December 15th |
| Duration of Living Lab Project | September 5th ~ January 15th |
| Title of the Living Lab Project | Using orange peels, lemon peels, and used cooking oil to make soap for students to use at school. |
| Project Summary | **What is the Problem?** The primary concern addressed by this project is the growing issue of food safety, particularly regarding the reuse and recycling of used cooking oil in food preparation. This oil, often recycled through rudimentary and unsanitary methods, poses significant health risks, including the potential for cancer, cardiovascular diseases, and other health issues. Used oil contains harmful substances such as trans-fats and aflatoxins, which can be toxic when consumed over time. Additionally, oil waste disposal is often handled improperly, contributing to environmental pollution.**What are the Attempted Solutions?** The project proposes a sustainable solution by recycling used cooking oil into soap, utilizing cheap and readily available raw materials, such as used cooking oil, orange and lemon peels, and beeswax. The soap produced can be used by students at school, offering a low-cost, environmentally friendly product that helps reduce waste and protect human health.**How Was the Project Implemented?** **Planning Stage:**  **-** Teacher divided class into 4 groups and assigned tasks for each group.  - Teacher collaborated to design a curriculum that integrates scientific research with practical applications.  - The project team conducted a survey to assess the community's support for using recycled oil and fat as a sustainable resource.  - Materials and tools were gathered, including used cooking oil, caustic soda, beeswax, and citrus peels.  **Implementation Stage:**  **- Refining the Used Cooking Oil:** The first step was to remove impurities and burnt residues from the used oil through manual filtration. Caustic soda was then added to the filtered oil to initiate the saponification process.  **- Soap Production:** The mixture of refined oil, caustic soda solution, and beeswax was blended to create a solid soap. The soap was poured into molds and left to solidify.  **Promotion and Monitoring:**  - Student leaders promoted the project and soap products by organizing events at school, where the soaps were distributed and used as part of daily hygiene routines.  - Teacher ensured that the project aligned with scientific learning objectives and encouraged students to document the process and their observations. **What Are the Outcomes?** **Increased Awareness of Environmental Sustainability:** One of the primary outcomes of this project is a heightened awareness among students, teachers, and the community about the importance of recycling and reducing waste. By turning used cooking oil and fruit peels into soap, participants learn how waste can be repurposed into useful products, which fosters an appreciation for environmental sustainability and the need to manage resources more responsibly.  **Improved Public Health Knowledge:** The project will help students and the community understand the dangers associated with reusing cooking oil and its potential health risks, such as the development of carcinogens, heart disease, and other chronic conditions. Through this initiative, people will be encouraged to adopt safer food practices, reduce the use of harmful oils, and increase their knowledge of better alternatives.  **Practical Skills Development:** Students will gain practical skills in the soap-making process, including understanding the science behind saponification, handling natural ingredients, and following step-by-step procedures. This hands-on experience can empower them with useful, everyday skills, such as how to make their own cleaning and hygiene products. These skills may also inspire them to explore other methods of sustainable living and problem-solving.  **Creation of Affordable, Eco-Friendly Soap:** A tangible outcome of the project is the production of eco-friendly soap made from recycled materials. This soap provides an affordable and sustainable alternative to commercial soaps, which often contain harmful chemicals and contribute to plastic waste. It can also serve as a prototype for larger-scale production, helping communities reduce reliance on mass-produced products that may be harmful to the environment.  **Community Engagement and Collaboration:** The project encourages community engagement as students share their knowledge with family members and neighbors, thereby spreading awareness of recycling and waste reduction. Collaboration among schools, local businesses (such as restaurants that can donate used cooking oil), and community members can help build a sense of shared responsibility for environmental sustainability. This outcome can lead to long-term partnerships that benefit both the community and the environment.  **Fostering Innovation and Creativity:** Students are encouraged to think creatively and innovatively when repurposing waste materials. They may experiment with different scents, textures, and ingredients to enhance the soap-making process. This innovative mindset can extend beyond this project and inspire students to approach other sustainability-related challenges with new perspectives and solutions.  **Educational Impact:** The project will deepen students' understanding of basic chemistry concepts such as chemical reactions (saponification), the properties of oils and fats, and the process of creating a product from waste. The integration of hands-on learning with real-world applications will enhance their scientific literacy and engagement in STEM subjects. Additionally, the project can be used as a tool to integrate other subjects, such as biology, economics, and social studies, to create an interdisciplinary learning experience.  **Reduction in Waste and Pollution:** The direct result of using used cooking oil and citrus peels is the reduction of waste that would otherwise contribute to landfill accumulation or pollution. Recycling these materials helps decrease the environmental impact of waste and promotes more sustainable practices in communities, potentially inspiring others to follow suit.  **Long-Term Impact on Consumer Habits:** Over time, this initiative could influence participants' habits and attitudes toward consumer products. By demonstrating how waste can be reused to create something functional, participants may be more inclined to purchase environmentally friendly products, reduce waste at home, and advocate for sustainable practices within their communities. |
| Implications | **Is this project helpful for your students somehow?**  The project of using orange peels, lemon peels, and used cooking oil to make soap has several important implications for various aspects of sustainability, health, and education.  **Environmental Impact:** By utilizing waste materials like used cooking oil, orange, and lemon peels, the project significantly contributes to reducing waste and promoting environmental sustainability. Used cooking oil, when disposed of improperly, contributes to environmental pollution. Recycling this oil into soap reduces its harmful impact on the environment. The project also promotes waste reduction by turning natural waste products into a useful item, soap, thus fostering an eco-friendly approach among students and the community.  **Health and Safety Awareness:** The project helps raise awareness about the dangers of consuming foods cooked with reused or contaminated oil, which can contain harmful substances that may lead to serious health issues like cancer, obesity, and cardiovascular diseases. By educating students on these risks, the project encourages safer food practices and the importance of health-conscious choices. Additionally, the soap produced is a safer and natural alternative to chemically-laden commercial soaps, which may contain synthetic additives harmful to skin and health.  **Cost-Effective and Practical Solution:** The soap-making process provides an affordable alternative to expensive store-bought soaps, which may be difficult for some families to afford. By making soap from easily available, low-cost materials, students and their families can create an essential product at a fraction of the cost. The project also promotes resourcefulness and self-sufficiency, teaching students practical skills that they can apply in everyday life.  **Educational Value:** The project serves as an excellent educational tool for students, introducing them to basic scientific principles such as the saponification process, chemical reactions, and the recycling of materials. It also encourages students to think creatively and critically about solving real-world problems. By incorporating environmental sustainability, public health, and practical chemistry, this project provides valuable hands-on learning experiences that students can build on in future academic endeavors.  **Potential for Broader Application:** As a cost-effective and environmentally friendly method, the soap-making process could be scaled up and implemented more widely, not only in schools but also in local communities and businesses. Local businesses, especially those in food-related industries, could be encouraged to donate used oil for recycling, further promoting sustainability and waste reduction. The model could also be expanded to include other materials and waste products for the creation of various household items.  **Community Engagement and Awareness:** The project can serve as a starting point for community engagement on broader issues related to waste management, health, and sustainability. As students actively engage in this process, they can spread awareness within their families and communities about the importance of waste recycling and the dangers of consuming unhealthy foods prepared with reused oils. The project fosters a culture of environmental responsibility and encourages community-wide collaboration for a cleaner, healthier environment.  In conclusion, this project has far-reaching implications that not only address immediate concerns such as health risks associated with used cooking oil and environmental pollution, but also provide educational benefits and practical solutions for sustainability. It has the potential to inspire broader change, making it a valuable initiative for both students and the community.  **Is there any limitation or downside of this project?**  While the project of creating soap from recycled cooking oil and fruit peels has many benefits, there are a few limitations or downsides to consider:  **Time-Consuming Process:** The soap-making process, especially when done with recycled materials, can be time-consuming. It involves several steps, such as collecting and cleaning the used oil, preparing the fruit peels, and carefully following the chemical processes involved in making soap (such as saponification). This might not be ideal for students who are on a tight schedule or have other competing priorities.  **Not All Oils and Peels Are Suitable:** Not all used cooking oils or fruit peels are ideal for soap-making. For example, oils that have been used to cook food with strong odors or certain fruits with highly acidic peels might not result in the best soap quality. Students may face challenges in selecting the right ingredients, which could lead to suboptimal or unsuccessful soap batches. This limitation may require extra guidance and experimentation.  **Unpredictable Results:** Soap-making can sometimes yield unpredictable results, especially when experimenting with recycled materials. The saponification process may not always work as expected, and the soap might not turn out with the desired consistency, texture, or fragrance. There might be instances where the soap does not fully harden or the end product is too harsh on the skin, which can lead to disappointment or frustration.  **Lack of Access to Proper Facilities:** Not all students or schools have the proper equipment or facilities to carry out soap-making, such as access to the necessary safety gear, ingredients, or even a suitable space for handling chemicals. Limited resources could make it difficult to implement the project effectively.  **Do you have any suggestions for improvement?** 1. **Time-Consuming Process:** **Solution:**  **- Streamline the Process:** Consider breaking down the soap-making process into smaller, manageable parts spread across multiple sessions. For example, one session could focus on collecting and preparing ingredients, while the next focuses on mixing and saponification. This would reduce the pressure on time and allow students to engage more deeply with each step.  **- Pre-Prepared Materials:** Provide students with some pre-prepared ingredients, such as cleaned and filtered used oil or dried fruit peels, which could save time on the more labor-intensive parts of the process. Alternatively, using pre-made soap bases (without fragrances or additives) for students to customize can reduce the complexity and time required. 2. **Not All Oils and Peels Are Suitable:** **Solution:**  **- Create a Guide for Suitable Ingredients:** Provide a clear guide on which oils and fruit peels work best for soap-making, explaining why certain oils (like olive, coconut, or sunflower) are better than others, and why some fruit peels might be more effective than others. This will help students make informed decisions.  **- Experiment with Various Oils:** Organize trial sessions where students can experiment with small batches using different oils and peels to understand how each one impacts the soap’s texture, scent, and quality. This could turn into a fun learning experience and reduce frustration when some batches don’t turn out as expected.  **- Teach About Waste Reduction:** Introduce the concept of "upcycling" to give students more flexibility in ingredient selection, explaining that certain oils may still be reused even if they have strong odors (for example, by infusing them with herbs or essential oils). 3. **Unpredictable Results:** **Solution:**  **- Start with Simple Recipes:** Begin with tried-and-tested, simple recipes using common oils and additives to ensure a higher success rate. Once students become familiar with the process, they can experiment with different ingredients and methods.  **- Provide a Step-by-Step Guide:** Ensure clear, well-structured instructions for each phase of the soap-making process, emphasizing key factors like temperature control, measurements, and safety. Having a well-documented process can reduce errors and increase the likelihood of a successful outcome.  **- Use Testing:** Have students test the final soap on small patches of skin (with proper supervision) to make sure it’s not too harsh. This would also introduce students to the concept of testing products for safety before widespread use. 4. **Lack of Access to Proper Facilities:** **Solution:**  **- Utilize Local Resources:** If the school lacks facilities, consider collaborating with local community centers, makerspaces, or businesses that can provide necessary equipment or spaces. This could also create partnerships with local organizations that are focused on sustainability.  **- Portable Kits:** Develop portable soap-making kits containing all the necessary ingredients and tools (such as gloves, goggles, pre-measured lye, and oils). This would allow students to carry out the process in class or even at home, reducing the need for specialized facilities.  **- Use Virtual Platforms:** For schools with significant resource constraints, you could use virtual classes or demonstrations. Instructors can provide detailed walkthroughs of the soap-making process, and students can engage in theoretical exercises, research, and observation. This will help bridge the gap until physical resources are available. **Additional Ideas:** **- Collaboration with Local Experts:** Invite guest speakers such as professional soap makers, environmentalists, or chemists to offer expert guidance on the process and its environmental benefits. This could also increase student interest and provide more insights into the complexities of soap-making.  **- Focus on Sustainability:** Emphasize the importance of recycling and sustainability throughout the process, even in the face of challenges. Encourage students to think creatively about how to address waste and resource scarcity, such as using biodegradable molds, reusable packaging, or composting fruit peels.  **- Create a Feedback Loop:** After the project is completed, allow students to reflect on their experiences and share feedback. Discuss what worked well and where they encountered challenges. This will not only improve the process for future projects but will also allow students to understand the real-world nature of experimentation and adaptation. |