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THE IMPACT OF LILIN HARUM LESTARI (LIME) INNOVATION PROJECT ON STUDENTS' PERFORMANCE IN SCIENCE EDUCATION

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Abstract: This study aims to evaluate the impact of the Lilin Harum Lestari (LIME) innovation project on students in science education at Sekolah Kebangsaan Permatang To' Kandu (SKPTK). This project is introduced as a green initiative to raise awareness about environmental conservation by promoting the recycling of used cooking oil and leftover crayons. The main objectives of this project are to enhance students' awareness of recycling and reduce improper waste disposal and utilize the innovation as souvenirs or school sale items. This study employed a qualitative research method, using observation as the primary instrument for data collection. Thirty-five Year 6 students participated in this study and data was collected based on their involvement in class. The result shows that in terms of teaching and learning, the LIME project has significantly improved students' understanding of recycling concepts through hands-on learning experiences and successfully increased students' interest and motivation by engaging them in exploratory and creative activities. This study also found that the project also supports inquiry-based learning, promotes environmental awareness, and encourages higher-order thinking skills (HOTS) among students as well as develop their skills as peer mentors in forming hypotheses in science subject. Overall, the LIME innovation project benefits students academically and socially through collaborative learning. By integrating the concept of Education for Sustainable Development (ESD) into the Science curriculum, this project has the potential to serve as an effective learning model in fostering environmental awareness and action among the younger generation.

Keywords: Innovation, recycling, sustainability, Science learning, sustainable education

INTRODUCTION

Recycling is a cornerstone of environmental sustainability, playing a vital role in preserving our planet for future generations. The practice not only reduces waste but also minimizes the extraction of natural resources, saves energy, and mitigates pollution. Recycling transforms materials like plastics, metals, paper, and even organic waste into reusable resources, contributing significantly to the circular economy—a model that emphasizes sustainability and resource efficiency.

However, the success of recycling initiatives is not solely dependent on infrastructure and policies. A critical factor lies in the mindset and habits of individuals, which need to be cultivated early in life. This is where the importance of creating awareness among young children becomes paramount. Therefore, it is crutial to instill this awareness in young children to foster eco-friendly habits early, shaping a generation that values sustainability. Through hands-on activities, they learn the importance of recycling while developing creativity, critical thinking, and a sense of responsibility to care for the planet.

This innovation project has been implemented to promote environmental sustainability and encourage the growth of green technology. The project adopts the concept of 'recreate,' which means creating something new through recycling. Used cooking oil and unused crayons are recycled into a new product, the Sustainable Scented Candle named *Lilin Harum Lestari* (LIME). Following the findings of this study, the campaign "Why Throw Away When It Can Be Used Again" was introduced. This campaign introduces the 4R concept: Reduce, Reuse, Recycle, and Recreate (create something new from old materials).

From an academic perspective, this innovation aligns with the primary school science curriculum, enabling teaching and learning to be conducted in an unpacked and modular way. For example:

i. Water quality – Related to the topic "Factors Causing Animals and Plants to Face Extinction" (Year 6 Science Textbook, Page 73).
ii. Food chain – Linked to the relationship between food and the photosynthesis process (Year 5 Science Textbook, Page 79).

Besides implementing the *Lilin Harum Lestari* (LIME) innovation project, this project also incorporates the concept of social entrepreneurship through the "Why Throw Away When It Can Be Used Again" campaign among students. Additionally, it raises students' awareness that the Earth is aging and requires care and attention from its inhabitants. Through the "Why Throw Away When It Can Be Used Again" campaign, this project also emphasizes the 4R concept which has been mentioned earlier.

The sustainability of this project lies in its ability to help society maintain their health by practicing recycling and reducing environmental pollution, which indirectly can assist in lowering the government's administrative expenses. Finally, the *Lilin Harum Lestari* (LIME) project is not only sustainable and low-cost but also has a significant impact on teaching and learning, the character development of students, and the cultivation of interest in STEM. The project's success at the national level demonstrates that students have immense potential in innovation, and such projects should be continued and expanded for broader benefits.

PROBLEM STATEMENT

Used cooking oil and unused crayons are usually discarded, causing environmental pollution. If the practice of disposing of crayons and used cooking oil remains uncontrolled, it can have negative impacts on the environment. This is because if used cooking oil is dumped into drains or rivers, it can form an oil layer on the water surface, blocking oxygen from entering the water and endangering aquatic life. If used cooking oil is poured into sinks, it can solidify and clog drains, increasing maintenance costs. When disposed of on the ground, used cooking oil can seep into the soil, disrupting nutrient balance and damaging plants. Moreover, the disposal

of used cooking oil contributes to greenhouse gas emissions; being hydrophobic, it decays anaerobically, producing methane gas, which accelerates global warming.

As for crayons, they are made of paraffin, a petroleum-based product that is not easily biodegradable. When discarded on land or in water channels, crayons can pollute water sources and disrupt ecosystems. Randomly discarded crayons may also pose risks to animals; if animals ingest crayon fragments, it could lead to health problems or even death, as these substances cannot be digested. Even when thrown into waste bins, paraffin-based crayons take a long time to decompose, contributing to plastic pollution at landfill sites.

Recognizing the negative impacts mentioned above, the *Lilin Harum Lestari* (LIME) innovation project was initiated. To ensure that this project delivers an effective impact, an initial step was taken by conducting a preliminary study through a survey among the school community to understand the optimal management of used cooking oil. The THE ToPS (To' Kandu Primary School) group studied the management of used cooking oil waste among 82 teachers and support staff at SKPTK. The findings revealed that 30 respondents (36.6%) faced difficulties in managing used cooking oil waste, while 52 respondents (63.4%) had already practiced recycling. This data indicates that many still require a solution for more effective used cooking oil management. Apart from being produced in various colors, these candles are made more appealing by incorporating natural fragrances such as pandan leaves, kaffir lime, cloves, green tea, and coffee as candle scents. The *Lilin Harum Lestari* (LIME) project is simple and suitable for implementation by primary school students as well as students with special educational needs, where the candles can be used as souvenirs or commercialized to generate income. This initiative not only contributes to environmental care but also aligns with one of the principles of the Malaysia MADANI economy, which encourages the growth of green technology.

RESEARCH OBJECTIVES

The *Lilin Harum Lestari* (LIME) project is an innovation aimed at educating all members of Sekolah Permatang To' Kandu (SKPTK) on the importance of preserving and conserving the environment, while promoting the growth of green technology. This is done by instilling knowledge about the importance of healthy and beneficial practices in recycling used cooking oil and leftover crayons in a simple and cost-effective way.

This innovation project has three main objectives as follows:

i. To provide knowledge and awareness to SKPTK members regarding the practice of recycling waste materials, particularly used cooking oil and crayons, so that these items, which were previously discarded, can become a source of income.
ii. To reduce water source pollution and ecosystem disruption caused by the disposal of crayons, while simultaneously protecting the environment.

iii. To utilize the results of this innovation project as souvenirs for school visitors or as saleable souvenirs for SKPTK.

RESEARCH METHODOLOGY

In the implementation process, the students actively participated as chefs, while the teacher acts as the Head Chef cum facilitator during the candle-making session. The process of making LIME candles is conducted through hands-on activity with emphasizing safety aspects and systematic procedures. Once the candles are produced, students are given the opportunity to sell them, transforming this innovation into a techno-entrepreneurial product that fosters a culture of STEM among students.

Respondents

This *Lilin Harum Lestari* (LIME) innovation project specifically involved Year 6 students because Year 6 students study topics related to Waste Materials in Unit 9 of the Year 6 Science Textbook. A total of 36 Year 6 students were involved in this innovation project (refer to Table 1 below). In addition, 3 teachers were also involved in this project, in which they acted as Head Chef and facilitator.

Table 1

Students Respondents of this project

Gender	N	%
Male	23	63.89
Female	13	36.11
Total	36	100

Materials Used for the Innovation and Steps to Produce Lilin Harum Lestari (LIME)

In the implementation of this project, students use basic materials such as leftover crayons, used cooking oil, and excess crayons. By utilizing recycled materials, this project not only reduces costs but also educates students on the importance of sustainable practices and environmental sustainability. Through this approach, students can learn how science and innovation can be applied practically without requiring significant expenses. It also helps them understand the concept of smart consumption and sustainable resource management in daily life.

The Sustainable Scented Candle Innovation Project (LIME) not only has a positive impact on Teaching and Learning (PdP) but is also highly cost-effective. This project involves a cost of less than RM1 as it uses waste materials based on the recycling concept (refer to Table 2 below).

Table 2

List of Materials and Costs

Item	Material	Price	Source
1	120 ml used cooking oil	RM 0.00	Recycled material
2	1 tablespoon oil hardener	RM 0.52	Purchased
3	Crayon color	RM 0.00	Recycled material
4	5 ml fragrance	RM 0.20	Purchased
5	Candle wick	RM 0.10	Purchased
6	Candle container	RM 0.00	Recycled material
	Total Cost RM 0.82		

The materials required for this project include:

1. 120 ml of used cooking oil
2. 1 tablespoon of oil hardener
3. 2 grams of crayon
4. 5 ml of fragrance oil (variety of scents can be used)
5. Water (for double boiler)
6. Popsicle sticks with holes drilled (to hold the wick upright) (refer Picture 1 below)
7. Candle wick
8. Candle container

Picture 1

Explaining instruction number 6

Preparation Steps:

Step 1

1. Heat the used cooking oil using the ‘double boiler’ method.
2. When the oil is hot, add the crayons and cook until the crayons melt.
3. Add the oil hardener and stir until evenly mixed.
4. Add the fragrance oil.

Step 2

1. Place the candle wick into the candle container (insert the wick’s end into the hole of the popsicle stick to hold it upright) (refer Picture 2 below)
2. Pour the candle mixture (prepared in Step 1) into the candle container and let it set.

Picture 2

Explaining step 2.1

Picture 3

Final product of *Lilin Harum Lestari*

Using Innovation in Teaching and Learning

The *Lilin Harum Lestari* (LIME) innovation project is not designed as a direct teaching aid. However, it has a positive impact on teaching and learning in various ways. Firstly, this innovation successfully enhances the understanding of science concepts among students involved in the project. Through hands-on activities and experiments, students can better comprehend scientific theories and relate them to real-life applications. Additionally, the project increases students' interest and motivation in learning Science. With a more interactive and enjoyable approach, students become more eager to explore new concepts and engage actively during learning sessions.

This project approach is also in line with Inquiry-Based Learning, where students are encouraged to explore, investigate, and build their own understanding through experiments and observations. This helps them develop scientific skills and foster creativity.

Furthermore, this innovation promotes environmental awareness among students. They gain a deeper understanding of the importance of sustainable materials and how innovation can contribute to environmental conservation, aligning with the concept of education for sustainable development.

Next, through active participation in this project, students also enhance their Higher-Order Thinking Skills (HOTS). They not only conduct experiments but also analyze findings, make comparisons, and solve problems that arise during the innovation process.

Lastly, the project provides students with opportunities to develop peer mentoring skills in forming hypotheses. They learn to collaborate, share ideas, and guide their peers in building and testing hypotheses, thus improving their communication and leadership skills.

CONCLUSION

The *Lilin Harum Lestari* (LIME) Innovation in Science Teaching and Learning gives positive impact to the students in multiple ways:

i. Enhancing understanding of scientific concepts

The *Lilin Harum Lestari* (LIME) innovation helps students better understand concepts related to waste materials in a more practical way. Through this project, students can directly observe how waste materials such as used cooking oil can be recycled into useful candles. This provides a hands-on learning experience and deepens their understanding of the recycling concept.

ii. Increasing Students' Interest and Motivation

The innovative approaches in teaching, such as *Lilin Harum Lestari* (LIME), make learning more engaging and enjoyable. Students become more excited to learn as they participate in exploratory and creative activities. This increases their motivation to explore science in depth and connect theory to everyday practices.

iii. Supporting Inquiry-Based Learning

Lilin Harum Lestari (LIME) encourages students to explore and investigate how waste materials can be recycled and reused. This allows them to develop critical and creative thinking skills in addressing environmental issues.

iv. Promoting Environmental Awareness

This project raises students' awareness of the importance of environmental preservation by reducing waste and encouraging the reuse of valuable materials. This aligns with the concept of Education for Sustainable Development (ESD) integrated into the science curriculum.

v. Fostering Higher-Order Thinking Skills (HOTS)

Through this innovation, students not only grasp basic scientific concepts but also have the opportunity to apply their knowledge in real-life situations. They can analyze, evaluate, and create something new.

vi. Sharpening Skills as Peer Mentors in Forming Hypotheses

The *Lilin Harum Lestari* (LIME) innovation project provides opportunities for students to act as peer mentors in the classroom. During experimental activities, students who better understand the concepts can assist their peers in forming related hypotheses, such as predicting the effects of waste materials on the environment if not recycled and making predictions about the effectiveness of used cooking oil in producing candles compared to commercial candles. Through such mentoring, students not only reinforce their own understanding but also help others develop scientific skills. This creates a more active and effective collaborative learning environment.

Additionally, the Lilin Harum Lestari (LIME) project not only benefits students individually but also help to build social and scientific skills among students through peer mentoring practices. Moreover, projects such as LIME allow students to develop practical skills such as problem-solving, innovation, and entrepreneurial thinking, which are essential for personal and professional growth.

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