Batik Science Demonstration Program (PODESABA) for the Enlightened Generation at the Sanggar Muhammadiyah in Kampung Baru, Kuala Lumpur, Malaysia

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Abstract

The Batik Science Demonstration Program (PODESABA) for the Enlightened Generation was conducted by the Department of Chemistry's community service team at Sanggar Muhammadiyah, Kampung Baru, Kuala Lumpur, Malaysia, in 2025. This international community service initiative aimed to introduce fundamental chemistry concepts through culturally contextualised learning, enhancing students' scientific literacy and creativity. The program comprised four main sessions: (1) a redox reaction demonstration using Betadine solution and citrus juice to visualize vitamin C presence, (2) a simple paper chromatography experiment to illustrate separation techniques, (3) an ecoprint batik workshop utilizing plant-based dyes and alum solution as a natural mordant, and (4) a jumput (tie-dye) batik activity using natural dyes. Each activity was designed to be interactive and culturally relevant, enabling participants to connect scientific principles with traditional batik-making practices. The program yielded positive outcomes, including heightened enthusiasm and active participation among children, improved comprehension of redox and separation concepts, and the creation of innovative batik products. This initiative successfully integrated science and art, embodying the spirit of The Enlightened Generation through cross-cultural collaboration and exchange.

Keywords:

Science demonstration; redox; simple separation; batik; jumput technique

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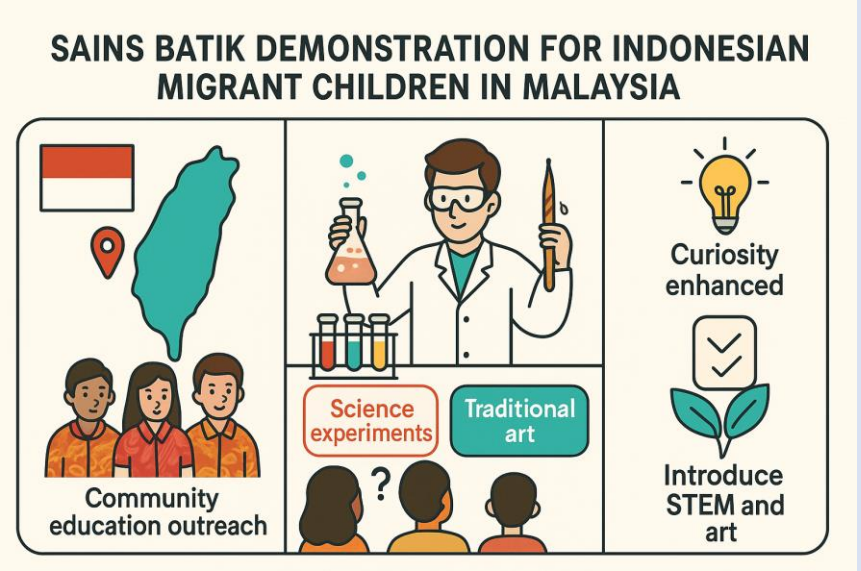
Graphical Abstract



Introduction

Kuala Lumpur, particularly Kampung Baru, is a residential hub for Indonesian migrant workers. Children from these families, especially those without legal documentation, face significant barriers in accessing formal education (Yuvanti, 2021). In response, the Muhammadiyah Guidance Studio was established as a non-formal learning centre providing basic education services for Indonesian children overseas. However, learning activities at the studio are currently limited to fundamental subjects such as reading, writing, and arithmetic, with minimal emphasis on science, art, or entrepreneurial skills (Rohman et al., 2023).

This creates a knowledge gap in science and practical skills among schoolchildren, leading to negative perceptions of science, particularly chemistry, which is seen as complex or hazardous. The lack of exploratory and enjoyable learning experiences exacerbates this issue. Furthermore, limited access to cultural arts-based skills, such as batik, hinders children's opportunities to develop creativity and entrepreneurial spirit from an early age (Komisia et al., 2024).

Through the Batik Science Demonstration Program (PODESABA), the team aims to introduce a contextual learning approach that combines science and art through interactive educational activities. The program enables children to grasp fundamental chemistry concepts through simple experiments, such as vitamin C tests and ink colour separation, while practising eco-friendly batik techniques through ecoprints and jumputan. This approach not only presents science in an engaging manner but also instils cultural values and economically valuable skills.

Method

The implementation of the Batik Science Demonstration Program (PODESABA) is part of a foreign service activity that aims to provide contextual learning experiences to children of the Indonesian migrant community in Kuala Lumpur, Malaysia. The method of the activity is designed to take into account the limited access to formal education these children face and focuses on developing their interest and a basic understanding of science and cultural arts in an integrated manner. The activity was carried out for 4 consecutive days with a proportionate division of time for theoretical activities, experiments, practice and evaluation of results. The learning approach is participatory and small-group-based, with the aim of fostering cooperation, curiosity, and courage in exploration. All activities are also designed to use materials that are safe, easy to find and relevant to daily life, so that they are easy to replicate in their homes or communities. Program planning began with identifying the learning needs of children at Sanggar Muhammadiyah Kampung Baru. Based on initial observations, most children have never been directly exposed to the practice of science and tend to see science lessons, especially chemistry, as difficult, confusing, and even scary. Therefore, the program is designed to introduce basic science concepts in a simple, fun, and non-intimidating form. The target of this activity is children aged 6–12 years who have not been registered in the formal education system due to parental legal status or socioeconomic conditions. In addition, studio teachers are also companion participants in the service activity. In each session, participants are divided into small groups of 6-10 people, and each group is facilitated by one companion from the service team. The use of collaborative learning methods is expected to increase participants' active involvement and create a mutually supportive learning environment.

Experiment Procedures

Where is the Vitamin C

Mix the Betadine solution into orange juice and lemon water in a transparent glass. The children observed that in samples containing high levels of vitamin C, the brown colour of Betadine faded, indicating a redox reaction. This method makes it easier to understand chemical concepts visually and safely.

Simple Separation Experiment

Create a colour pattern using a marker on perforated filter paper. In addition, a roll of paper to be inserted into the hole and placed on a glass filled with water. The water that rises due to capillarity carries ink pigment, so there is a color separation that can be observed by children. These experiments foster curiosity through direct observation of scientific phenomena.

Ecoprint Batik

In the ecoprint training, a cloth soaked in an alum solution is used. Then arrange the fresh leaves and flowers on a cloth, roll them up, and steam them for two hours. This process

transfers the natural pigment to the fabric's surface. After the fabric cools and opens, you can see the unique natural batik motif.

Jumput Batik

Form a pattern by wrapping a marble in a cloth and then tying it using an elastic band. The fabric is dipped in a salted or vinegared dye solution, then dried and unbonded. The result is aesthetic patterns created from parts unaffected by colour.

Results & Discussion

PODESABA Team were held from Wednesday, August 06, 2025, to August 09, 2025, in Kuala Lumpur, Malaysia. This program was prepared and attended by 50 students in grades 1-6, lasting 4 days. During the implementation, the community service team carried out a series of practical and counselling activities, including vitamin C test demonstrations, simple separation techniques, making ecoprint batik, and jumput batik. Participants involved showed high enthusiasm and actively participated in each session. This activity not only provides practical skills but also opens up insights into the sustainable use of natural materials and the application of basic science in daily life.

Figure 1. PODESABA: Batik Science Demonstration at Muhammadiyah Office, Malaysia

Where is The Vitamin C

In this service activity, the team delivered applied chemistry education through direct experiments with participants to test the vitamin C content in packaged drinks using a simple ingredient: the antiseptic Betadine. Before the practice began, participants first got an explanation of the basic concept of the redox reaction, which is the working principle of the vitamin C test and the importance of vitamin C content for the body. Participants in the activity were students and teachers, divided into small groups so that all could try the experiment independently. The implementation began with a brief introduction to the experiment's purpose: to examine differences in vitamin C content across several types of packaged drinks. After that, each group chose a sample of the drink. Each sample is poured into a 10 ml clear glass. The team then guided participants to drip a diluted Betadine solution (1:10) into the drink while stirring gently.

Figure 2. Vitamin C Assay of Tablet Samples

During the experiment, participants looked enthusiastic about observing the colour change. For example, in orange juice, the brown colour of Betadine disappears immediately after the first few drops, which is admired because it indicates a high vitamin C content. Conversely, when Betadine is dripped into a drink, the brown colour remains or fades only slightly. This provoked discussion among the participants, because it turned out that not all fruit-flavoured drinks or popular drinks contain vitamin C. Many students are excited to re-experiment with different drinks. Overall, this vitamin C test activity not only provides an understanding of simple chemical reactions (redox), but also trains participants to think critically about daily consumption products. The activity was interactive, full of discussions, and ended with a joint reflection on the importance of choosing foods and drinks that are truly nutritious. This aligns with the research of Resti et al. (2024), who stated that vitamin C content testing practicum can improve students' critical thinking skills and nutritional awareness, and is commonly used in food chemistry learning to train analytical skills. This visualisation is especially important in basic chemistry learning because it helps participants understand how a chemical reaction can be observed directly through colour indicators. Thus, the experiment not only conceptually introduced redox reactions but also strengthened participants' understanding of how chemical changes can occur in everyday life.

Simple Separation Experiment

As part of a series of science education activities at Sanggar Muhammadiyah Malaysia, the community service team conducted a simple mixture-separation experiment to introduce students to the basic principles of capillarity and simple chromatography. This experiment was designed with a fun concept to make it easy for children to understand. Each student received equipment consisting of filter paper, coloured markers, and a glass filled with water. The team started by creating a circular pattern around the filter paper hole with a marker, then placing a roll of paper in the centre until it formed a small umbrella. After that,

students enthusiastically imitate the move. When the paper umbrella is placed on top of the glass, the tip of the paper roll begins to touch the water, and slowly the colour from the marker rises to the surface of the paper. This process of change excites children. They noticed how the colours of the markers that initially seemed single began to unravel into layered patterns and spread out beautifully. Some students seemed to shout with joy when they saw the results of different patterns in each group. This leads to simple discussions, such as why black can break down into blue and purple, or why red spreads faster.

Figure 3. Chromatography Test of Ink Colours using Filter Paper

The participants' response was very positive. They not only learn about the scientific phenomena of capillarity and pigment separation, but also get creative with the colour patterns that they create themselves. The studio's accompanying teacher also said that this method can be used as an alternative to learning science that is engaging for children, as it combines elements of experimentation, art, and creativity. Based on research (Utariningrum, 2025), the simple separation method is an effective approach in science learning because it connects theoretical concepts with participants' practical experience. This activity ultimately became one of the most memorable sessions for students. Through this simple experiment, children gain a real experience of science while growing their curiosity about everyday phenomena.

Ecoprint Batik Training

The community service activity in Malaysia featured an ecoprint batik training session to introduce environmentally friendly textile technology and highlight the economic potential of natural resources. The training participants, comprising community mothers, teenagers, and studio teachers, enthusiastically engaged in each stage of the process. The activity commenced with an introduction to the fundamental principles of ecoprinting and the significance of utilising natural materials. Participants were then guided in preparing cotton

fabrics that had undergone scouring to remove factory starch. Subsequently, they collectively performed the mordanting process, soaking the fabric in an alum solution for approximately 1 hour. While waiting, the team explained the role of the mordant in enhancing the adhesion of leaf and flower pigments to fabric fibers.

The next stage involved selecting local leaves and flowers. Participants arranged teak leaves, kenikir, virgin footprints, and castor leaves on the fabric, showcasing their creativity through symmetrical patterns or freestyle designs. The atmosphere became increasingly lively as the fabrics were rolled, tied with ropes, and steamed for approximately 2 hours. During this period, participants discussed small-business opportunities for ecoprint fabrics and marketing strategies for these exclusive crafts.

The most anticipated moment arrived when the fabric was unwrapped after cooling. A collective gasp of amazement was heard as the leaf and flower motifs became visible on the fabric surface, each displaying a unique colour palette. Some fabrics showcased the reddish-brown hue of teak leaves, while others exhibited a combination of yellowish-green colours from kenikir flowers. Participants admired the results, appreciating the beauty and high artistic value of the ecoprint fabrics, as no two fabrics were identical.

Figure 4. Ecoprint Batik Produced

The training concluded with a colour fixation practice to enhance motif durability, followed by a reflection session where participants shared their experiences. Many expressed pride in producing their first ecoprint, and most hoped this activity would continue through a follow-up workshop or collaborative effort. Ecoprinting offers an innovative alternative in batik production, utilising natural plant pigments, minimising waste, and supporting sustainable education in art and science (Syafril & Agel, 2024). This ecoprint batik training provided participants with a creative experience, fostering awareness that environmentally

friendly textiles can be a valuable business opportunity and strengthening cultural cooperation between countries.

Jumput Batik Training

The team provided a medium for creating jumput batik, offering an alternative science-learning approach through traditional, technique-based fabric-dyeing practices. This activity taught the aesthetic process of pattern-making, using cotton fabric, marbles, and rubber bands to form motifs, and textile dyes mixed with salt as a fixator. Each team member designed a pattern by wrapping marbles in cloth and tying them tightly, sparking curiosity about the unique pattern that would emerge after dyeing.

Figure 5. The process of forming a jumput batik motif

The dye solution was prepared in a saucepan with salt, and the tied cloth was immersed in it for approximately 30 minutes. After removal, the cloth was drained and sun-dried. Upon untieing, distinctive patterns of contrasting colors emerged on the fabric surface. Team members enthusiastically welcomed the results, noting the unique motifs on each fabric. This simulation demonstrated that the jumput technique can teach cultural elements and basic science principles, such as dye dispersion and chemical interactions with fabric fibers. The jumputan technique, a traditional ikat-dip batik method, is widely used in art learning due to its simplicity and ability to foster cultural appreciation (Kurniastuti et al., 2023). The simulation results indicate that this activity is suitable for direct practice with Kampung Baru students, as it is simple, enjoyable, and combines art and science aspects.

Figure 6. The Jumput Batik Produced

Evaluation of Community Service Activities

The pie chart in Figure 6 illustrates participant engagement and enthusiasm across the four main sessions of the Science Batik Demonstration Program (PODESABA). The Kain Jumput activity had the highest participation rate (34%), followed by Simple Separation (30%), Batik Ecoprint (20%), and where is the Vitamin C (16%). This distribution reflects participants' preference for hands-on, creative activities such as Kain Jumput and Simple Separation. The Kain Jumput session combined chemistry with aesthetic expression, while Simple Separation used chromatography to teach separation concepts and colour mixing. Batik Ecoprint received positive responses, with participants learning about natural dyes and mordant chemistry. The Where is the Vitamin C demonstration introduced redox reactions effectively. Participants showed strong enthusiasm for activities that combine science and art, promoting active learning and scientific curiosity among children and aligning with the program's goals.

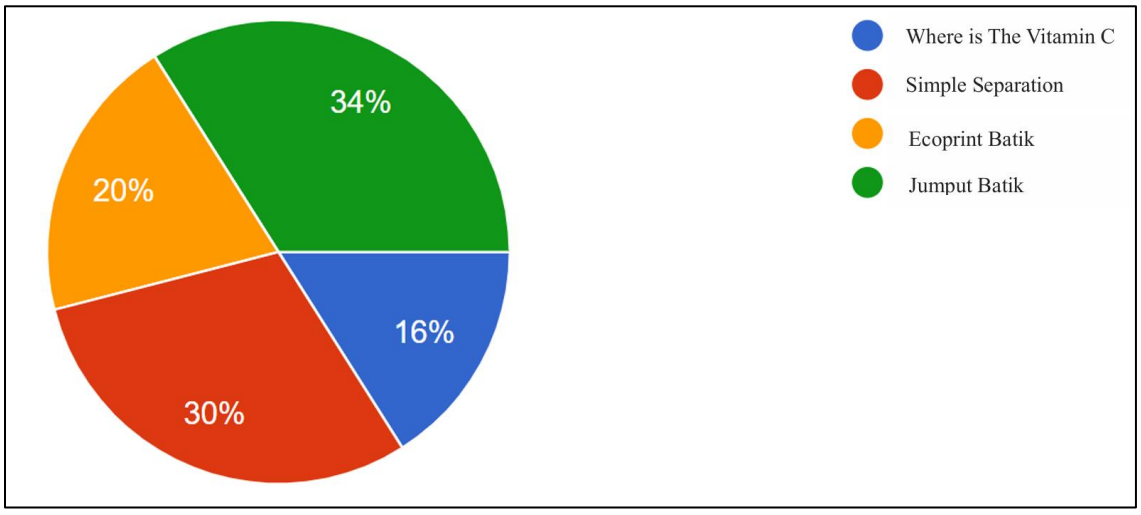


Figure 7. Interest Survey Results

Impact of Overseas Community Service

This service activity has yielded a positive impact on both Universitas Negeri Malang (UM) and the Special Branch of Muhammadiyah Kuala Lumpur, Malaysia. The collaboration has led to mutual agreements, including an Implementation Agreement for sustainable service based on SDG 4 (Quality Education) and SDG 17 (Partnership to Achieve Goals). Additionally, it has opened internship opportunities for UM students, guided by principles of progressive and impactful teaching.

Conclusion

PODESABA's service activities at Muhammadiyah Malaysia have successfully provided participants with hands-on experience in science and environment-based art, including vitamin C tests, chemical separation, ecoprint batik, and jumput batik. This program has not only boosted participants' creativity and skills but also strengthened collaboration between Universitas Negeri Malang (UM) and Muhammadiyah Malaysia, ultimately advancing applied science education and preserving sustainable culture.

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