

# Empowering Youth for a Sustainable Water Future: Scienceporium Community Engagement in Vietnam

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**Abstract:-** Access to clean water and sanitation remains a critical challenge for Vietnamese population. In 2022, it was reported that only 57.8% of the Vietnamese population had access to safely managed drinking water, significantly below the Southeast Asia average of 74.3%. Additionally, studies have reported that microbial contamination levels in the surface water exceeding the permissible limits by 2.14–7.02 times, posing heightened risks of waterborne diseases. Scienceporium: Sustainable Water Future program was conducted in Da Nang district in collaboration between Universiti Teknologi PETRONAS (UTP) and FPT University. This program featured STEM-based workshops aimed at enhancing the youths' understanding of SDG 6 and fostering practical skills in problem solving. Furthermore, a community engagement project was conducted at the Da Nang Street Children Protection Centre, where a water filtration system was installed to provide residents with access to clean drinking water. These efforts aimed to empower participants to actively contribute to clean water and sanitation initiatives, addressing the pressing water quality challenges in Vietnam.

**Keywords:-** Clean Water and Sanitation, SDG 6, Water Filtration, Community Engagement, Sustainable Water.

## I. INTRODUCTION

Access to clean water and sanitation is a fundamental human right, essential for health, economic development, and environmental sustainability. Sustainable Development Goal 6 (SDG 6), established by the United Nations, aims to ensure universal access to clean water and sanitation by 2030, underscoring global efforts to tackle water-related challenges. In Vietnam, despite ongoing reforms and development efforts, a significant number of the population still facing lack of access to safely managed water and adequate sanitation facilities. There are multiple factors that contribute to the intensified water pollution which include rapid urbanization, industrialization, and agricultural expansion that placing Vietnam's water resources under considerable strain and creating a dire need for concerted actions (Strokal et al., 2021; World Bank, 2022).

Historically, Vietnam's clean water and sanitation issues have been worsened by limited water infrastructure while more focus is placed on economic growth over environmental protection. Only 57.8% of Vietnam's population had access to safely managed drinking water in 2022, significantly below the Southeast Asia average of 74.3% (World Bank, 2022). Rural areas are disproportionately affected, as most infrastructure improvements have focused on urban regions. Consequently, residents in rural communities often depend on untreated surface water, exposing them to harmful contaminants from agricultural and industrial waste (Tuan et al., 2024).

The health risks associated with poor water quality and inadequate sanitation in Vietnam are substantial. Waterborne diseases such as diarrhea, cholera, and dysentery are prevalent, primarily affecting children in rural and low-income areas. A recent study highlighted on the issue of *E. coli* contamination in surface and drinking water sources, which exceeded the permissible levels and posed significant health risks to the human (Santos et al., 2023). *E. coli* contamination is commonly attributed to the untreated sewage discharge and inadequate waste disposal practices, which remain common in rural Vietnam due to insufficient sanitation infrastructure. The health implications of these contaminants are severe, as prolonged exposure can lead to gastrointestinal infections, weakened immunity, and chronic health issues, including malnutrition in children (Les, 2011).

Arsenic contamination is another serious issue that impacts health security in Vietnam. Research conducted found arsenic levels in tap water exceeding WHO safety standards in certain regions, increasing the risk of cancer, skin lesions, and cardiovascular diseases for those reliant on these water sources (My et al., 2024). The prevalence of these hazardous contaminants underscores the urgency for interventions to improve water quality and sanitation facilities across Vietnam.

The Scienceporium: Sustainable Water Future program is a collaborative initiative between Universiti Teknologi PETRONAS, Malaysia (UTP) and FPT University, Vietnam, to address these issues by engaging Vietnamese youth in SDG 6 through hands-on STEM workshops and community projects. The SDG 6 workshop introduced students to the sustainable water management principles, encouraging them to devise solutions for local water issues through collaborative problem-solving. Meanwhile, the DIY water filter workshop provided practical knowledge by involving students in

constructing water filtration models, reinforcing the importance of clean water access and the technical challenges involved.

Additionally, the initiative extended its impact through a community project at the Da Nang Street Children Protection Centre, where a water filtration system was installed to provide clean drinking water access for residents. This intervention served as both a health safeguard and an educational tool, reinforcing SDG 6 values among community members. Such initiatives are crucial in addressing Vietnam's water and sanitation crisis by fostering the youth generation with deep understanding on the importance of SDG 6 so they become the advocates for sustainable water solutions.

## II. METHODOLOGY

There were four phases involved in realizing this program; planning phase, pre-implementation phase, implementation phase, and post-implementation phase.

### A. Planning Phase

During this phase, clear objectives were outlined and should be aligned with SDG 6, with the focus on raising awareness, imparting knowledge, and fostering active participation in clean water and sanitation initiatives. FPT University was identified as the local collaborator while Da Nang Street Children Protection Centre was chosen as the target beneficiaries.

A detailed budget plan was prepared to ensure all required resources for travelling, accommodation, workshop materials and community services were covered. The plan also included possible sources of funding from both internal and external parties. Participants (or volunteers) were also equipped with necessary training in cultural sensitivity, facilitation skills, and technical knowledge required for water filtration workshop. In addition, bilingual instructional materials were developed to overcome the language barriers that may occur during the workshop.

### B. Pre-Implementation Phase

Most crucial part in this phase was the workshop modules development. Two modules were developed for the SDG 6 awareness workshop and DIY water filter workshop. The first module focused on the introduction of water sustainability concepts through interactive activities such as quizzes and group discussions. While the second module provided hands-on learning through constructing and testing the water filtration systems. Other activities at the orphanage were also planned including refurbishing the living spaces and organizing interactive sessions to foster the community spirit.

The coordination and venue preparation at FPT University and Da Nang Street Children Protection Centre was managed by FPT University team as the local collaborator, which includes preparation of necessary materials for the workshop such as supplies for DIY water filters, educational aids, and painting materials for refurbishing the community center. UTP team finalized the

travel arrangements including transportation and accommodations.

### C. Implementation Phase

The activities were planned and executed for four consecutive days. Day 1 was the orientation and awareness workshop to introduce the children to the program objectives. They were also introduced to the SDG 6 and facilitated to understand the concept through multimedia presentations, quizzes, and group activities to engage the participants. Later, the participants were guided to construct water filter system and tested the efficiency of their design using five different types of dirty water. The winner was chosen based on the performance of their filtration system.

Day 2 and 3 were filled with cultural immersion activities to enrich the participants' experiences and foster deeper appreciation of Vietnamese culture. These activities aimed to create a holistic learning environment, enhancing cultural awareness and interpersonal connections among participants from both UTP and FPT University.

A water filtration system was installed at the Da Nang Street Children Protection Centre on Day 4, together with refurbishment activities such as removing moss, wall painting and decorations. The volunteers were engaging with the orphans by sharing moments of joy through singing, dancing, and playing games. The aims of the activities were to not only improve the physical conditions of the centre, but also focused on creating meaningful interactions and bringing smiles to the faces of the children in Da Nang.

### D. Post-Implementation Phase

This phase was divided into two parts; immediate and future post-implementation. Immediately after the activities, feedback was collected through surveys to measure and evaluate the effectiveness of the whole program implementation. For the workshop activities, surveys were conducted to assess their understanding and satisfaction. Additionally, the effectiveness of the constructed water filter systems was evaluated using several types of dirty water to determine the best design. When the system was installed at the community center, the functionality and impact of the system was further tested. Direct feedback from the residents was also gathered. Additionally, it was equally important to collect reflections from the volunteers from both UTP and FPT University. The reflections covered their learning experiences and areas for improvement.

Proper documentation was important for reporting of the detailing project outcomes, lessons learned, and recommendations for future initiatives. The results then were shared with stakeholders, including UTP and FPT University, through presentations and publications to inspire similar initiatives. Periodic follow up was also planned with Da Nang Street Children Protection Centre to ensure the sustainability of the installed system and to continue fostering the partnerships with FPT University.

### III. RESULTS AND DISCUSSION

Although the actual activities were executed within 4 days, the project planning and management took almost one year from the start to the completion. During the phases, students learned and developed relevant skills that are useful and non-teachable through formal classes. It is important to stress the crucial part where students from both universities developed a deeper understanding of SDG 6 challenges and their interconnections, which further enabled them to become a more informed and culturally aware global citizen. Consequently, this initiative has provided the platform and encouraged students to use their knowledge and skills for the betterment of communities, both locally and globally, while fostering a sense of responsibility and empathy. Furthermore, the partnership served as a foundation for sustained growth and cooperation in addressing global challenges related to SDG 6, benefitting not only to the participating institutions but also the wider community.

#### A. Impact of the Workshops

Implementation of the developed modules for the SDG 6 awareness workshop and DIY water filter workshop were the focus of this program. The impact of these activities was assessed on children, local communities, volunteers, and other main stakeholders. Figure 1 (a-c) illustrates the activities conducted during the SDG 6 awareness workshop. The children were highly engaged during the session and actively participated in each activity. The workshop enhanced their understanding of the importance of clean water and sanitation, aligning with SDG 6. Activities such as interactive discussion, mind mapping, and online quizzes helped the children to connect global water challenges to their local context. They have displayed high interest and are able to communicate the concept in their own words which proved their deeper understanding (Mackie, 2019).







Fig 1: Introduction to SDG 6 (a), Group Discussion to SGD Concept (b), Presentation Session (c)

Figure 2 (a-c) shows the hands-on water filtration system activity that the children went through during the workshop. Through the DIY water filter activity, the students have acquired practical skills in constructing and testing their water filtration systems. This experience has deepened their understanding on water purification processes and emphasized the challenges in ensuring safe water access to their communities and surroundings.

Apart from the physical impact observed on the children, these group-based activities also aimed to encourage teamwork, develop critical thinking and innovation skills when they collaborated to identify possible solutions for clean water challenges. These skills are essential for addressing real-world issues effectively. These engaging and meaningful activities have motivated the children to become advocates for clean water and sanitation in their communities. They will be the activists in promoting sustainable practices among their peers and family members.



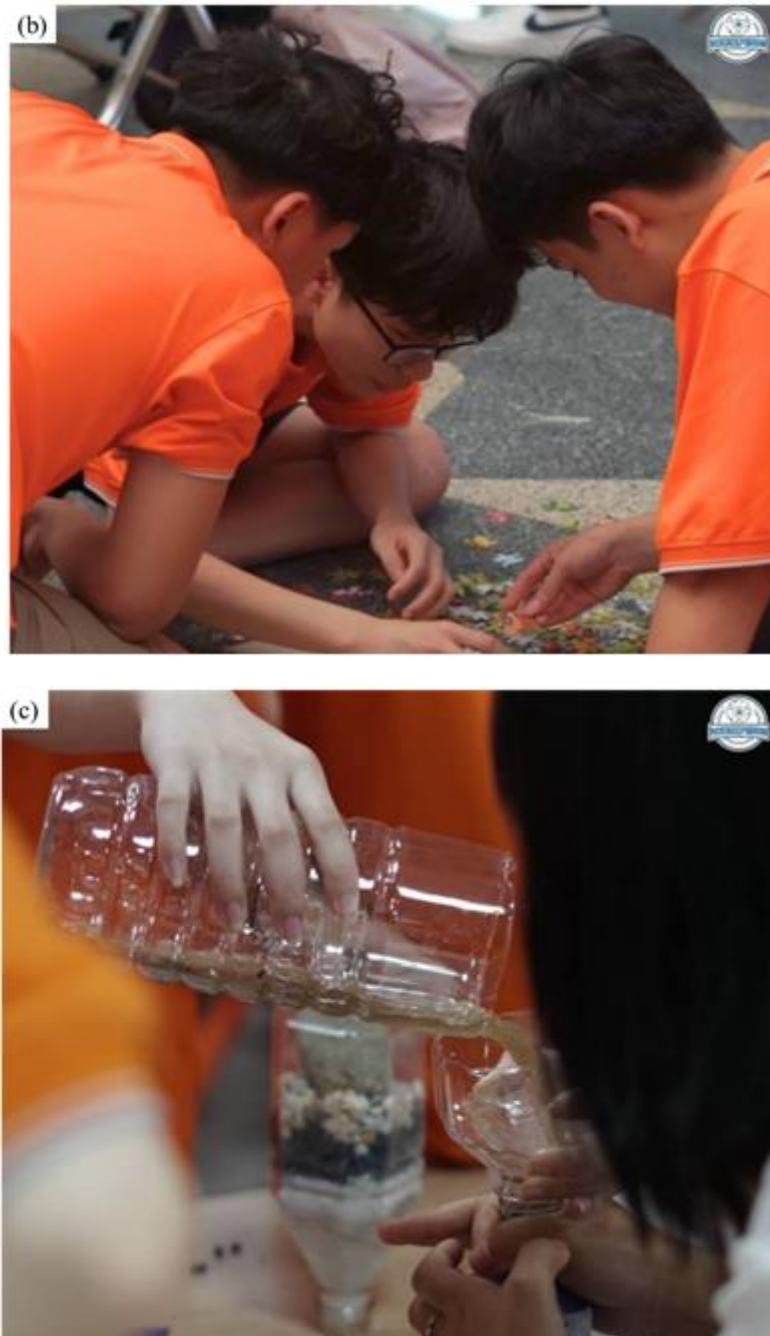


Fig 2: Volunteers from UTP (a), Water Filtration System Development (b), Performance Testing of the System (c)

The workshop activities were not only impactful to the students, but it is also extended to the volunteers who unswervingly involved in the whole process of the program. Volunteers have enhanced their facilitation and communication skills through the valuable experience in leading the workshops, delivering the content, and interacting with the children. Their ability to communicate complex topics to the young children effectively is something plausible. At the same time, the volunteers also reported of increased confidence in managing group activities and addressing diverse needs from the children. This has reinforced their ability to drive a meaningful educational and community-oriented initiatives which would be beneficial in their future.

Interestingly, this program also benefited the surrounding community from the increased awareness about the importance of clean water and sanitation when the children shared their learnings beyond the workshop setting. This approach further enhanced the sustainable impact of the imparted knowledge during the DIY water filter activity. Consequently, it has the potential to inspire local innovation and adaptation of low-cost water filtration solutions in the households or schools. This program also became a platform to connect university students with the local communities through engaging activities. At the same time, they have demonstrated the importance of education and collaboration in solving pressing societal issues.

#### *B. Impact of Community Engagement Activity*

The installation of a fully operational water filtration system at Da Nang Street Children Protection Centre had significantly improved the quality of drinking water available for the children, consequently reducing the risk of waterborne diseases and enhancing their overall health and well-being. During the program, the volunteers also helped to remove the moss and revitalized the walls with new paintings. It has revitalized the orphanage by creating a more hygienic and visually appealing environment, and further uplifting the space for the children to live and learn. At the same time, the interactive activities such as dancing, singing and playing games have fostered joy and strengthened the children's sense of belonging to their place. All these events have beneficially supported their emotional and social well-being, creating cherished and valuable memories that will be long-lasting.

Direct engagement with the underprivileged children allowed the volunteers to experience personal growth and enhanced their empathy, which deepened their understanding of the importance of addressing social and environmental issues. By witnessing the positive effects of their efforts towards the children, the volunteers have acquired a sense of achievement and motivation to participate in future community service initiatives. Collaborative efforts between volunteers and the community members also have fostered the community spirit, strengthened their bonds and created a shared sense of purpose.

#### C. Overall Impact of the Program

Overall, the Scienceporium: Sustainable Water Futures program had a profound and comprehensive impact on all individuals and groups involved, both directly and indirectly. By integrating educational workshops, community engagement activities, and cultural exchanges, the program has conveyed meaningful contributions across several dimensions.

The important aspect of SDG 6 has been embedded into the participants through interactive workshops and allowed students to explore real-world challenges in their familiar environments. The DIY water filter activity further deepened their technical knowledge and demonstrated the importance of resource management and innovation. It has also inspired them to become future advocates with a strong sense of responsibility and motivation to drive positive change within their communities. Additionally, the different language and cultures which initially were the program barrier, has cultivated the participants with diverse interpersonal and teamwork skills. The cultural activities, such as lantern-making and exploring Hoi An, enriched their global perspectives and deepened their appreciation for Vietnam's cultural heritage.

Collaboration between UTP and FPT University, with other stakeholders, has reinforced the strong relationships and paved the way for future joint efforts in addressing global challenges. Furthermore, this impactful initiative has increased the visibility and credibility of both institutions and boosted their reputation as advocates for sustainable development. It has also demonstrated how educational

institutions can create meaningful changes for the community. Its success served as a strong model for replicable, impactful programs in other regions.

#### IV. CONCLUSION

The community engagement activity at Da Nang Street Children Protection Centre has created a ripple effect of positive impact directly to the children's quality of life, enriching the volunteers' experiences, while benefitting the local community and stakeholders at large. This initiative emphasized the importance of combining technical solutions with social engagements to foster sustainable development and community resilience. The program has exemplified how collaborative, hands-on, and educational approaches can generate a widespread and long-lasting impact to individuals and communities. From empowering the children and the volunteers to transforming community health and infrastructure, the program has delivered tangible benefits while advancing sustainable development goals.

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