



Empowering Rural Communities to Support the Development of Educational Tourism Through Organic Hydroponic Farming Training in Sido Mulio Village, Langkat

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ABSTRACT

Sido Mulio Hamlet is a village with a lot of vacant land that can be used for hydroponic farming. This community service activity aims to increase the knowledge, skills, and empowerment of the community through training in organic hydroponic vegetable cultivation in support of the development of village edu-tourism. The activity was carried out from April to November 2025 using a participatory approach through the stages of socialization, training, production practice, mentoring, and evaluation. The method used was pre-experimental with measurements taken before and after training. Data were collected through questionnaires, observations, and focus group discussions, then analyzed descriptively. The results of the activity show a significant increase in community knowledge related to hydroponic cultivation, irrigation system installation, and plant nutrition management. This increase in knowledge contributes directly to improved practical skills and independent adoption of hydroponic technology. In addition, this activity has an impact on increasing the economic capacity of the community through the production of hydroponic vegetables and their use as a means of agricultural education. This activity confirms that practical organic-based hydroponic training supported by mentoring can have a real impact on community empowerment and the strengthening of community-based rural edutourism.

Keywords: Edutourism, Hydroponics, Nutrition, Organic, Sustainable Agriculture.

ABSTRAK

Dusun Sido Mulio merupakan desa yang memiliki banyak lahan kosong yang dapat dijadikan sebagai lahan untuk membuat tanaman hidroponik. Kegiatan Pengabdian kepada Masyarakat ini bertujuan untuk meningkatkan pengetahuan, keterampilan, dan keberdayaan masyarakat melalui pelatihan budidaya sayuran hidroponik berbasis organik dalam mendukung pengembangan eduwisata desa. Kegiatan dilaksanakan mulai bulan April sampai dengan November 2025 menggunakan pendekatan partisipatif melalui tahapan sosialisasi, pelatihan, praktik produksi, pendampingan, dan evaluasi. Metode kegiatan yang digunakan adalah pra-eksperimental dengan pengukuran sebelum dan sesudah pelatihan. Data dikumpulkan melalui kuesioner, observasi, dan diskusi kelompok terarah, kemudian dianalisis secara deskriptif. Hasil kegiatan menunjukkan adanya peningkatan pengetahuan masyarakat yang signifikan terkait budidaya hidroponik, instalasi sistem irigasi, serta pengelolaan nutrisi tanaman. Peningkatan pengetahuan tersebut berkontribusi langsung terhadap peningkatan keterampilan praktik dan adopsi teknologi hidroponik secara mandiri. Selain itu, kegiatan ini berdampak pada peningkatan kapasitas ekonomi masyarakat melalui produksi sayuran hidroponik dan pemanfaatannya sebagai sarana edukasi pertanian. Kegiatan ini menegaskan bahwa pelatihan hidroponik berbasis organik yang bersifat aplikatif dan didukung pendampingan mampu memberikan dampak nyata terhadap pemberdayaan masyarakat dan penguatan eduwisata desa berbasis komunitas.

Kata Kunci: Eduwisata, Hidroponik, Nutrisi, Organik, Pertanian Berkelanjutan.



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1. Introduction

The development of the education-based tourism sector tourism education has become an important strategy in promoting sustainable rural economic growth through the productive use of local potential. Edutourism not only serves as a means of recreation, but also as a medium of learning that contributes to increasing the knowledge, skills, and capacity of communities in managing village resources [1]. The development of community-based Edutourism has proven to be able to improve the welfare of local communities while strengthening the sustainability of the rural economy [2]. However, the implementation of Edutourism at the village level, especially in Sido Mulio village, still faces various obstacles, particularly limited human resource capacity, low productive land utilization, and a lack of innovation in technology-based economic activities that can provide added value and strengthen tourist appeal [3]. The integration of the agricultural sector with the concept of Edutourism through the application of organic hydroponic technology is considered a relevant solution. Hydroponics enables the cultivation of horticultural crops on limited land with high efficiency in water and nutrient use, as well as producing healthier and more environmentally friendly products [4].

Sido Mulio Hamlet, Langkat Regency, is one of the areas that is being developed into an edu-tourism village through the management of the Village-Owned Enterprise. Although several village economic programs are already underway, the utilization of the agricultural sector as a vehicle for edu-tourism is still not optimal. One of the main problems faced by the community is the limited agricultural land due to land conversion and the low level of knowledge and skills of the community in applying modern environmentally friendly agricultural technologies. This condition has resulted in the potential of agriculture as a source of income and a medium for education not being fully utilized.

Organic-based hydroponic crop cultivation is a relevant alternative solution to these problems. Hydroponic technology enables the production of horticultural crops in small areas with high efficiency in water and nutrient use, as well as producing cleaner and healthier products. The integration of hydroponics with an organic approach through the use of liquid organic fertilizers from agricultural and livestock waste is also in line with the principles of sustainable agriculture and environmental management [5]. In addition to its potential to increase food security and community income, hydroponic cultivation can be developed as a means of agricultural education for students and tourists [6].

However, the application of organic-based hydroponic technology at the village community level still faces challenges, particularly related to low technology adoption rates, limited facilities and infrastructure, and suboptimal business management and marketing capabilities. In line with previous community service activities, it has been shown that although hydroponic technology and liquid organic fertilizers have great potential to increase crop productivity and quality, their successful implementation is highly dependent on aspects such as continuous training, technical assistance, and strengthening community management capacity [7-9]. Most of the hydroponic activities reported in previous studies still focus on technical aspects of cultivation, while studies that integrate hydroponics as an instrument for community empowerment and strengthening village Edutourism are still limited.

Based on these issues, a community empowerment approach is needed that not only emphasizes technology transfer, but also capacity building, independence, and active participation of rural communities in managing businesses based on local potential. This Community Service activity aims to analyze the role of organic hydroponic cultivation training in increasing the capacity and empowerment of rural communities, as well as its contribution to supporting the development of edu-tourism. The results of this study are expected to provide a model of community empowerment based on sustainable agriculture that can be replicated in other rural areas with similar characteristics.

2. Methods

This Community Service Activity uses a descriptive-participatory study design with a pre-experimental approach (one-group pretest–post-test design). This method is used to evaluate changes in knowledge, skills, and community empowerment levels before and after the implementation of organic-based hydroponic cultivation training. The activity was carried out in Sido Mulio Hamlet, Langkat Regency, from April to November 2025. The materials used were horticultural seeds (water spinach), rockwool growing media, AB Mix nutrient solution, liquid organic fertilizer based on agricultural and livestock waste, and clean water. The tools used were Nutrient Film Technique (NFT) hydroponic system installations, water pumps, PVC pipes, net pots, TDS meters, pH meters, and other cultivation support tools.

The stages of implementation of the community service activity used are socialization. This activity is useful for increasing community knowledge about the use of vacant land, motivating the community to grow hydroponics at home, helping the community engage in positive activities, generating sales value if done properly, helping the community protect the environment, helping the community reduce household waste, and helping the community produce organic vegetables that are free of pesticides and chemicals. The activity was conducted by inviting all residents of Sido Mulio hamlet to gather, and the volunteer team presented materials related to organic-based hydroponic cultivation using PowerPoint presentations and a projector equipped with a screen.

Training: This training activity aims to improve participants' skills and knowledge. The training is conducted by combining lectures, discussions, and demonstrations. The material presented through lectures includes the basic concepts of organic-based hydroponics, an introduction to the Nutrient Film Technique (NFT) hydroponic system, the selection of horticultural plant varieties, the principles of using organic liquid nutrients and fertilizers, and the management of hydroponic businesses in supporting the development of village edutourism. The production practice stage is carried out directly through demonstrations and intensive mentoring. Participants are guided through each stage of cultivation, including sowing seeds using rockwool media, transferring seedlings to hydroponic installations, mixing and applying nutrients and liquid organic fertilizers, adjusting pH and nutrient concentration, plant maintenance, and harvesting.

Technology Application: The community implements the technology directly with the assistance of the community service team. The community can apply the knowledge gained during socialization and training so that they can assemble hydroponic media and containers, starting from being assisted to working independently. In this activity, the community is also trained on how to apply production and management aspects so that they gain independent and sustainable skills.

Assistance and Evaluation: The assistance and evaluation stages are carried out by the community service team by comparing the conditions of the partners before and after the program implementation. The indicator of program success is the positive changes in the partners (business development) after the program implementation. The community service team presents the results of the community service implementation from the solutions that have been offered. During this evaluation stage, the community service team also distributes questionnaires about the mentoring activities carried out. The results of this evaluation are only used to determine and analysed how the participants of the mentoring activities responded to the community service program from the implementers so that they can hopefully run a better hydroponic eduwisata program.

Program Sustainability, this stage is the final stage in this community service activity. It involves monitoring and ensuring that the benefits of the program continue to be felt by the target community, even after the main program has been completed. This includes efforts to build local capacity so that the community can continue and develop the initiatives that have been started. Strengthening local capacity to continue the initiatives that have been started ensures progress and the identification and development of local resources to support program sustainability and the establishment of long-term support mechanisms.

3. Result and Discussion

The Community Service Program under the Community-Based Empowerment Scheme, specifically in the area of Community Partnership Empowerment, began with a survey and discussion with the head of the Bangun Mandiri Village-Owned Enterprise (BUMDes) on August 1, 2025. Following discussions with the head of the BUMDes and some of its members, it was concluded that the BUMDes was in the process of implementing hydroponic farming technology. Subsequently, preparations for the hydroponic house and the installation of the hydroponic irrigation system were carried out over a period of approximately one month.

Activities in the socialization and training stages on horticultural plant sowing, rockwool sowing techniques, transplanting to net pots, and AB-mix nutrient techniques for hydroponic plants were carried out on Sunday, August 31, 2025, from 10:00 a.m. until completion. The socialization event was held at the home of the head of the Bangun Mandiri Village-Owned Enterprise (BUMDes) in Sido Mulio Hamlet, Bekiung Village, Kuala District, Langkat Regency, and was attended by 45 people, including a team of volunteers, farmers, and young people interested in growing vegetables using hydroponics. The results of the socialization activities are presented in the following image.



Figure 1. Implementation of the Sido Mulio Hamlet Socialization activity on Hydroponic Cultivation.

The implementation of socialization takes the form of providing knowledge and materials to farmers on how to cultivate hydroponics from start to harvest so that, in the future, the community can do it independently or understand how to make simple hydroponic media to be practiced in their own yards. The community understands the process of growing hydroponic plants from seedling to harvest, resulting in fresh, healthy, and high-quality produce. Understanding the benefits of hydroponics can foster entrepreneurship starting from one's own backyard, and the community begins to care about environmental cleanliness and is able to sort organic and inorganic waste.

3.1. Changes in community knowledge.

Knowledge and skill indicators in hydroponic cultivation are divided into four parts, namely knowledge of hydroponic cultivation, knowledge of hydroponic irrigation installation, preparation of AB mix and its dosage for water spinach plants, and application of AB mix and measurement of plant requirements. Although almost all participants demonstrated their understanding of these four sections, due to limited training time, not all participants had the opportunity to practice using the hydroponic installation. As a result, there were still 7 people who did not understand the procedure for using this installation. This is shown in Figure 2.

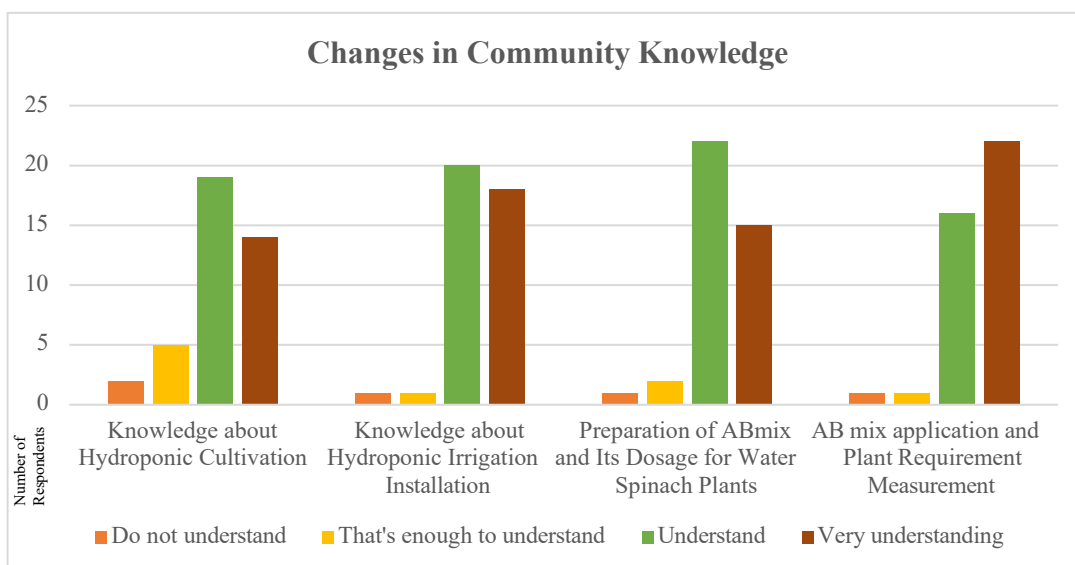


Figure 4. Changes in community knowledge.

The graph above shows a significant increase in public knowledge after the implementation of the organic-based hydroponic cultivation training program. Before the activity, some respondents were still in the categories of “do not understand” and “that's enough to understand” for all knowledge indicators, especially those related to hydroponic cultivation, irrigation installation, and the preparation and application of AB mix nutrients. After the training and mentoring, there was a clear shift towards the categories of ‘understand’ and “very understanding” in all aspects measured.

This increase in knowledge directly supports the main objective of the program, which is to improve the community's capacity to independently adopt hydroponic technology. A good understanding of cultivation systems, installation, and nutrient management is essential for the successful implementation of hydroponic technology at the village level. This is in line with research stating that controlled agricultural technology will have a real impact at the community level when accompanied by an increase in human resource capacity [10]. Thus, the results shown in the graph not only reflect an increase in understanding, but also serve as a foundation for improving practical skills, community independence, and the use of hydroponics as a means of education and productive economic activity in supporting village edutourism.

4. Conclusion

The conclusion of this activity is that organic-based hydroponic cultivation training can significantly improve the knowledge and skills of the community, which is the basis for the successful independent and sustainable adoption of hydroponic technology. This capacity building contributes directly to the achievement of the program's main objectives, namely community empowerment and the strengthening of village edutourism through the use of hydroponics as a means of production, education, and productive economic activity. This confirms the importance of integrating sustainable agricultural technology with a community empowerment approach in supporting village development. Furthermore, it is recommended to assess the long-term impact and economic aspects of hydroponic businesses and their broader integration into the development of edutourism in the Sido Mulio hamlet community.

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