



Food Security Education through Hydroponic Co-curricular Activities in the Kurikulum Merdeka as Sustainable Education

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Abstract:

This research aims to describe the implementation of co-curricular activities with the theme of sustainable lifestyles through hydroponics as an effort in food security education. This research uses a descriptive qualitative approach with eleventh-grade students at SMA Katolik Karitas III Surabaya as the research subjects. Data were collected through document studies, including co-curricular modules, project reports, daily monitoring, and assessment rubrics. Data analysis was conducted through data reduction, data presentation, and conclusion drawing. The research results show that co-curricular activities through hydroponics can foster values of collaboration and creativity, although the achievement of critical reasoning dimensions still needs to be improved. Students showed active involvement in designing, maintaining, and harvesting hydroponic plants, which impacted the improvement of their understanding of the concept of food security. This activity also strengthens food literacy through hands-on practice and exploration of environmentally friendly vegetable cultivation technology. In addition, this co-curricular activity promotes a sustainable lifestyle, such as upcycling used materials, water conservation, and waste reduction. Research results show that hydroponic co-curricular activities are relevant to sustainable development goals or SDGs, especially SDG 4 and SDG 12. Schools play an important role as real learning spaces and agents of sustainable lifestyle change for students. Thus, co-curricular activities not only serve as a means of contextual learning but also strengthen character, 21st-century skills, and concern for food and environmental issues.

Keywords: Kurikulum Merdeka, Co-curricular, Hydroponic, Sustainable Education, Food Security

Introduction

The Sustainable Development Goals (SDGs), known as global goals, were established by the United Nations (UN) in 2015. This development aims to create a better, fairer, and more sustainable life for everyone. The integration of these SDG programs is capable of balancing social,

economic, and environmental sustainability. The quality of education is the SDGs 4 program that aims to ensure inclusive and equitable quality education and promote lifelong learning opportunities for all (Saini et al., 2023). The education referred to includes equipping students with knowledge, skills, and values for a productive and responsible life. The SDG 12 program highlights responsible consumption and production, which can be integrated with the SDG 4 program. Education can teach life values such as energy conservation, waste reduction, and responsible consumption (García-González et al., 2022). Education with a sustainable lifestyle can shape environmentally conscious habits from an early age (Arga & Sapriya, 2024), through active learning approaches such as hydroponics, urban farming, and recycling. Therefore, education as the foundation for achieving sustainable development goals plays an important role in creating awareness and behaviour in addressing various global issues (Abera, 2023).

To meet these demands, the Indonesian government introduced co-curricular activities through the Kurikulum Merdeka that are designed to strengthen, deepen, and enrich intracurricular activities (Badan Standar, Kurikulum, dan Asesmen Pendidikan Kementerian Pendidikan, Kebudayaan, Riset, dan Teknologi Republik Indonesia, 2024). Co-curricular activities primarily aim to assist students in understanding, deepening, and internalizing intracurricular concepts while fostering responsibility, character development, and practical skills through hands-on learning experience (Shilviana & Hamami, 2020). In addition, intracurricular activities play a strategic role as a means to support at the achievement of the Graduate Student Profile dimensions (Faizah, 2025). When compared to the co-curricular program in the previous Kurikulum Merdeka, which was more identical to project-based learning, co-curricular activities now have a wider variety. Co-curricular activities can be carried out in various forms, such as individual or group assignments, projects based on contextual themes or local wisdom, simple research, creation of works/papers, educational/field visits, and even projects (Aliyah et al., 2025).

According to co-curricular activity guidelines, the Indonesian government does not mandate a single fixed theme; instead, schools can independently develop themes based on their specific needs. Nevertheless, sustainable living serves as a relevant contextual choice. This theme has become increasingly crucial amid escalating environmental issues and global food security challenges (Gell & Paige, 2023). Internalising a sustainable lifestyle from an early age is expected to shape a generation that is caring and responsible towards environmental preservation (Shalahuddin et al., 2025). One way to implement this theme is through gardening activities, specifically by creating hydroponics. Hydroponics serves as an interactive learning medium for students, not only by implementing scientific knowledge such as understanding plants but also by helping to understand the principles of sustainable agriculture with the aim of motivating students to be more interested in learning science in a fun and meaningful way (Kwok

et al., 2021). Hydroponics was chosen as the main activity due to its high relevance to sustainability issues. Activities involving hydroponics in learning have been proven to enhance students' understanding of sustainable development, where students not only possess environmental awareness such as environmental preservation but also have social awareness in engaging in activities related to economic empowerment (Hartadiyati et al., 2020).

Hydroponics also serves as an effort to educate students about small-scale food security. Students learn to produce their own food, an effort that aligns with the Indonesian government's *Asta Cita* program to achieve food self-sufficiency and support the improvement of food security at the community level (Pambudi et al., 2022). Initiatives like this are important to raise awareness and provide practical knowledge to students about how to preserve the environment (Zega et al., 2023). When compared to conventional agriculture, hydroponics is considered to use less water, land, and reduce the use of pesticides and chemical fertilisers (Rajendran et al., 2024). Hydroponic practices and training in schools make students better understand plant cultivation as food security (Suharno et al., 2023), in addition, students show interest in learning hydroponics compared to conventional agriculture (Oktavia, 2024). Food security that students can learn about is that hydroponics allows students to produce their own fresh vegetables without relying on external supplies and supports local food availability (Sousa et al., 2024; O. Wang et al., 2025).

This research is unique because it focuses on SMA Katolik Karitas III Surabaya, which is located in a densely populated urban area, where the integration of hydroponics not only serves as a medium for science learning but is also utilised across disciplines through the block system of the Kurikulum Merdeka. This school serves as a real testing ground for how the values of food security and plastic waste recycling are systematically practiced on a mid-high institutional scale. Furthermore, although research on the effectiveness of co-curricular activities and the application of hydroponics in schools (Mulu et al., 2024) has been extensively conducted, studies that specifically and thoroughly describe the implementation process of co-curricular activities promoting a sustainable lifestyle through hydroponics at the high school level are still limited. This research is important to fill that gap and provide a comprehensive picture for educational practitioners regarding the implementation of co-curricular activities with the theme of sustainable lifestyles through hydroponics. The purpose of this research is to provide a detailed description of the implementation of co-curricular activities themed around sustainable lifestyles through hydroponic activities as an effort to educate food resilience among 11th-grade students at SMA Katolik Karitas III Surabaya.

Literature Review

Co-curricular Activities in the Kurikulum Merdeka

Detailed explanations regarding the definition and implementation of co-curricular activities have been elaborated in detail in the Co-curricular Guidebook compiled by Badan Standar, Kurikulum, dan Asesmen Pendidikan Kementerian Pendidikan, Kebudayaan, Riset, dan Teknologi Republik Indonesia (2024). Co-curricular activities are learning activities conducted to strengthen, deepen, and/or enrich intramural activities in order to develop competencies and strengthen students' character. Co-curricular activities aim to support the achievement of the eight dimensions of the Graduate Profile in a tangible and contextual manner. These eight dimensions are: faith and devotion to God Almighty, citizenship, critical thinking, creativity, collaboration, independence, health, and communication. Based on the co-curricular guidebook, this activity can be carried out in three main forms: collaborative learning across disciplines, the Seven Habits of Highly Effective Indonesian Children movement known as 7 KAIH, and other methods based on local uniqueness or wisdom, school-specific values, or government policies. In this guidebook, it is also explained that the main characteristics of co-curricular activities include being flexible, contextual, deep learning, planned, and not burdensome.

Food Security Education

Food security education is a learning process or educational approach aimed at increasing the knowledge, awareness, and practical skills of individuals and communities regarding the importance of food availability, quality, sustainability, and self-sufficiency (Rohman et al., 2025). The goal of food security education is to strengthen food independence, meaning it can equip individuals with the understanding and skills to produce food independently (Yuliana et al., 2024). as the application of modern and sustainable agricultural technology (Nikmatullah et al., 2023), developing food and nutrition literacy (Abera, 2023), and solutions to land limitations and climate change (Shalahuddin et al., 2025). Food resilience education can be conducted in the school environment by integrating innovative agricultural materials and hydroponic practices into the curriculum, co-curricular activities, or school projects to foster an environmentally conscious character and early food awareness among students (Rohman et al., 2025). In addition, food security education can also be conducted in community and family environments that can serve as productive food sources (Widowati et al., 2023).

Research Methodology

This research uses a descriptive qualitative approach to explore how co-curricular activities themed around sustainable lifestyles are implemented in Phase F as part of efforts to educate students about food security. The research subjects consisted of 112 eleventh-grade students (Phase F) and 6 supervising/facilitating teachers at SMA Katolik Karitas III Surabaya. Data were collected through the study of various project documents, including the "hydroponics" co-curricular activity module, project planning reports, daily monitoring logs of hybrid or digital-based plants, project final reports, and student profile assessment rubrics. The assessment rubric analyzed was independently developed by the school's curriculum development team, referring to the Pancasila Student Profile Strengthening Project Development Guide from the Ministry of Education and Culture (2024). To ensure the validity and objectivity of the data, the researchers applied source and method triangulation techniques by comparing student report document data, digital recapitulation scores from facilitators, and teacher reflection notes. The researcher analyzed these documents following the Miles and Huberman stages through three phases: data reduction (sorting and focusing on relevant information), data presentation (organizing data into narrative form), and conclusion drawing. The data reduction phase serves as a key technique to simplify data analysis and support the formulation of conclusions.

Results and Discussions

Results

Planning and Preparation of Co-curricular Activities

Co-curricular activities have become a regular agenda at the school where at least two to three co-curricular activities are conducted each year for every student in each cohort, featuring different themes and activities. At SMA Katolik Karitas III Surabaya, a co-curricular team was formed from several teachers as planners and coordinators of the activities. At least one person represents each field of study in the high school with the hope of fostering collaboration between disciplines. In addition to fostering the Graduate Profile, this activity can also serve as a form of interdisciplinary learning that integrates two or more disciplines to examine a specific problem or topic. These co-curricular activities are conducted in a block system over several days, taking into account the time required for the co-curricular activities and the density of activities undertaken by the students. All co-curricular activities are conducted at school based on projects, and none are done at home. In addition to facilitating the assessment of students, this

aims to strengthen the achievement of the Graduate Profile established within the dimension of co-curricular activities.

The co-curricular team sets the activities that students will undertake throughout the academic year. These co-curricular activities are, of course, adjusted to the academic calendar and other activities undertaken by the students. Class X or phase E has three co-curricular activities during one academic year, while classes XI and XII in phase F each have two co-curricular activities. Regardless of the mid-semester and end-of-semester exams, this provision is implemented considering that phase F has much denser activities and agendas compared to phase E, including the Computer-Based National Assessment (ANBK) in grade XI and school and national exams in grade XII. Additionally, it is known that grade XII has a more intensive effective learning period compared to grades X and XI due to preparations for the final exams. Each theme of the designed co-curricular activities is selected based on the analysis of the school's potential, students' needs, socio-cultural conditions, and the dimensions of the graduate profile that need to be strengthened. This theme will later be used to determine the title of the activity and other aspects used during the co-curricular activities, such as dimensions, administrative preparations, and assessment instruments.

In this research, the chosen co-curricular theme is a sustainable lifestyle with the title of the activity being hydroponics. The co-curricular team then prepares assessment instruments for the co-curricular activities based on the Graduate Profile dimensions that students must achieve. Project assessments are conducted with a focus on three dimensions of the Graduate Profile (Table 1), in line with the co-curricular goal of developing students' character. (Badan Standar, Kurikulum, dan Asesmen Pendidikan Kementerian Pendidikan, Kebudayaan, Riset, dan Teknologi Republik Indonesia, 2024). The three dimensions of the Graduate Profile used in this co-curricular activity are critical reasoning, collaboration, and creativity.

Table 1. Selection of Dimensions for the Pancasila Graduate Profile on Sustainable Living

Dimension	Definition
Critical Thinking	The critical thinking dimension refers to individuals who possess curiosity, are capable of logical and analytical thinking, can analyse and solve problems, argue logically, and utilise literacy and numeracy to solve problems.
Collaboration	The collaboration dimension refers to individuals who are accustomed to caring and sharing, as well as building cooperation with various groups in their surroundings.
Creativity	The creativity dimension refers to individuals who are capable of being productive, creating innovations, and formulating solutions to problems in their surroundings.

(Source: Badan Standar, Kurikulum, dan Asesmen Pendidikan Kementerian Pendidikan, Kebudayaan, Riset, dan Teknologi Republik Indonesia, 2024)

Table 2. Assessment Indicators for Graduate Profiles on the Theme of Sustainable Living

Dimensions, Aspects Being Assessed, and Assessment Techniques	Assessment Indicators			
	Lacking (L)	Sufficient (S)	Good (G)	Very Good (VG)
Dimension: Critical Thinking				
Aspect being assessed: Analysing and evaluating the reasoning used in finding and seeking solutions as well as making decisions	Student cannot solve problems/obstacles (more than 6 obstacles)	Student has difficulty solving problems/obstacles (4-6 obstacles)	Student can solve problems/obstacles (1-3 obstacles)	Student can solve problems/obstacles very well (no obstacles)
Assessment technique: daily report assessment				
Dimension: Collaboration		Project	Project	
Aspect being assessed: Building a team and managing cooperation to achieve common goals according to the predetermined targets.	Did not participate	outcome is less than/not in accordance with the initial plan	outcome is somewhat in accordance with the initial plan	Project outcome is very much in accordance with the initial plan
Assessment technique: Project outcome evaluation and peer collaboration evaluation	< 40	59 - 40	79 - 60	> 80
Dimension: Creativity				
Aspect being assessed: Exploring and expressing thoughts and/or feelings in the form of works and/or actions, as well as evaluating them and considering their impact and risks for oneself and the environment using various perspectives.	Student does not create a work	Student does not create a hydroponic source/example and uses newly bought items	Student does not create a hydroponic source/example but uses used items	Student creates a hydroponic source/example and uses used items
Assessment technique: Work assessment (hydroponic container)				

(Source: Tim Kegiatan Kokurikuler SMA Katolik Karitas III Surabaya, 2025)

In line with the regulations and the guidelines for the implementation of co-curricular activities (Badan Standar, Kurikulum, dan Asesmen Pendidikan Kementerian Pendidikan, Kebudayaan, Riset, dan Teknologi Republik Indonesia, 2024), the government provides guidance in setting criteria for evaluating co-curricular activities. However, these criteria do not serve as graduation requirements in co-curricular activities but rather as achievement levels used in assessments. If the assessment results show that there are dimensions of the graduate profile that have not been achieved or are still in the "Lacking/Sufficient" category, this does not disqualify the student but follow-up actions will be taken as outlined in the guidelines. This follow-up can be carried out by reviewing the aspects that caused the non-achievement and the obstacles faced by the students. The dimensions that have not yet been achieved are continued and reinforced in the co-curricular activities in the following academic year. Table 2 is the indicator used to measure the achievement of the objectives of the co-curricular activities with the theme of sustainable lifestyle. The dimension of critical reasoning with aspects that are assessed includes analysing and evaluating reasoning and its procedures. The assessment technique is focused on the analysis of daily monitoring reports, where teachers evaluate students' ability to identify problems and formulate innovative solutions during co-curricular activities. Therefore, the hydroponic co-curricular activities are expected to develop critical thinking attitudes. The achievement of students is assessed from "Good" to "Very Good," with the target in Phase F being that students are able to solve problems and overcome obstacles faced together with their group during co-curricular activities. The collaboration dimension with aspects that are assessed include cooperation and the overall evaluation of the project results, as well as the assessment of cooperation by group members. The expected target is that students are able to align their actions with those of others to achieve a common goal, as seen from the division of tasks and active involvement of students, as well as the alignment between the plan and the final outcome of the project. The dimension of creativity with aspects of producing original works and actions is measured through direct observation of the final product made by the students, which is a hydroponic container made from recycled materials. The assessment of the creativity dimension focuses on the originality of the design, recycling innovation, and aesthetics. The target of Phase F is for students to be able to explore and express their thoughts in the form of works, as well as evaluate them. This is viewed from the students who create sources or examples of hydroponics and use recycled materials as a form of expression of thoughts and works.

After this planning has gone through the revision process and been approved by the principal, the administrative tools for co-curricular activities are then compiled based on government regulations as the reference. This module contains several main components, namely activity planning documents,

assessment instruments and rubrics, implementation documents, evaluation documents, and supporting appendices. The first document, the activity planning document, includes (1) the Project Implementation Plan document containing the theme and title of the project, the goals and dimensions of the Graduate Profile, the project activity flow, dimension achievement indicators, and learning and assessment strategies, (2) the co-curricular activity module, (3) the activity timeline accompanied by dates, activity details, responsible persons, and facilitators' names, and (4) the Decree of the co-curricular activity team explaining the teacher as the facilitator and co-curricular supervisor at the school. The second document contains assessment instruments and rubrics based on the dimensions of the Graduate Profile, observation formats, and facilitator notes, as well as peer assessment and self-assessment formats. The third document is the implementation document, which includes (1) group formation and task distribution formats for students, each accompanied by a group facilitator, (2) a daily hydroponic monitoring template that includes the monitoring date, officer's name, actions taken by students, problems and solutions identified, signatures, and documentation, (3) a project result presentation template that includes the background of the hydroponic activity title, planning and actual hydroponic work, monitoring report, impressions and messages from the hydroponic co-curricular activity. The fourth document is prepared by the co-curricular team after the co-curricular activities have concluded. This document contains (1) files of photos and videos of co-curricular activities as a school portfolio and reports to the education office and school committee, (2) a final report on co-curricular activities by the teacher or facilitator that includes reflections, processes and results of the activities, recommendations, and (3) attendance lists of students and teachers as facilitators. There is administration created by the co-curricular team digitally through a spreadsheet application, including attendance lists and student grades for each session. The attendance list is compiled digitally to facilitate access for facilitators who change according to the learning schedule of each class. Additionally, the activities conducted in the co-curricular program are dynamic, so this digitalisation of administration aims to anticipate documents being damaged or lost during the activities. This digital grade list also makes it easier for the co-curricular team to obtain the final assessment results of the students, making the process of compiling co-curricular reports more practical and efficient.

Implementation of Co-curricular Activities

Co-curricular activities with the theme of sustainable lifestyle are carried out by students in phase F at SMA Katolik Karitas III Surabaya. This activity invites students to learn about and directly practice hydroponics at school in order to educate them about simple food resilience. The teachers who formed

the co-curricular team have created plans and activity details, assessments, and administration used during the co-curricular activities. The activities were carried out comprehensively over three months, starting with pre-curricular activities aimed at providing training and preparation for students. The implementation of the project is divided into seven main structured sessions as shown in Figure 1.

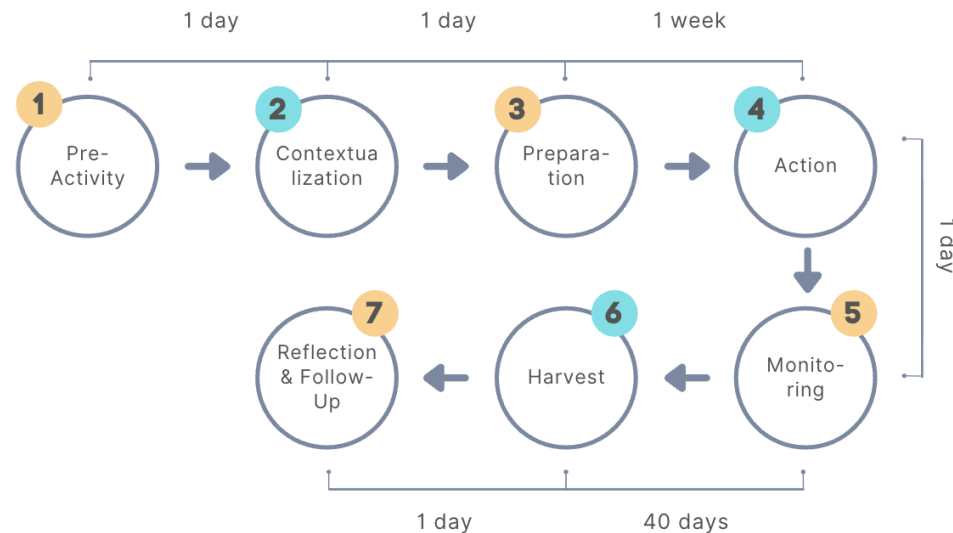


Figure 1. Implementation Stage of Co-curricular Activities with the Theme of Sustainable Lifestyle
(Source: Processed Data, 2026)

The first session, pre-curricular activities, includes socialisation and conceptualisation for the students. The activity began with a socialisation on the theme, the issue of plastic waste, the introduction to hydroponics, and food security. In addition to receiving material related to hydroponics, the students also watched an inspirational video on sustainable living. After the presentation of the material, it was followed by the formation of heterogeneous student groups consisting of 6 people per group. The second session, contextualisation and project planning. Students who have been grouped together design a simple hydroponic system from plastic waste. The results are presented in a hydroponic planning report with a standardised format: model title, type of plants (must include water spinach and one chosen plant), tools and materials, design image, method of construction, location, and task distribution. Session three is the preparation stage, where each student in the group is given one week to gather tools, materials, plant seeds, and rockwool planting media that will be used according to the group's needs. In the fourth session, the students enter the action or implementation stage. The implementation session begins with students creating hydroponic containers from bottles or used containers, which are then decorated and planted with hydroponic plant seeds. At the end of the session, the students compile a hydroponic monitoring report for daily recording. The fifth session involves monitoring activities that last for 40 days.

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Each student takes turns monitoring the plants according to the duty schedule determined within the group. The monitoring activities are recorded in a predetermined report, specifically in the monitoring table. This table includes the monitoring date, the name of the officer, the actions taken by the students, the problems and solutions identified, signatures, and documentation. This report will be submitted weekly as one of the formative assessments in the co-curricular activities. After 40 days, the students will enter session six, which involves harvesting the hydroponic plants and subsequently completing the data for the final report. Session seven is reflection and follow-up, where each group presents the project results using the prepared template. The presentations conducted consist of the title of the hydroponic activity, planning and actual hydroponic work, monitoring reports, and impressions and messages from the hydroponic co-curricular activities. Before concluding this session, the students, along with other groups, were gathered together to conduct a joint evaluation and reflection.

In addition to the implementation of co-curricular activities carried out by the students, daily meetings are held in the afternoon involving teachers as facilitators, the co-curricular team, and the principal. The purpose of this meeting is to serve as a forum for discussion, evaluation, and reflection related to the implementation of co-curricular activities on that day. This daily evaluation and reflection are used to optimise the implementation of co-curricular activities on the following day. This meeting also serves as an administrative monitoring session that must be completed by the facilitators. Administrative monitoring is deemed important because there have been findings where facilitators did not provide student assessments as they were still grading in other administrative documents. In addition to being an effort to increase the involvement of all school parties, this is necessary to minimise dependence on the co-curricular team during co-curricular activities. The hope is that teachers will take responsibility for the assessments given as facilitators and pay more attention to the process and achievement of co-curricular activities.

Discussion

Assessment of Student Graduate Profile Dimensions The assessment

Data from the three dimensions of the Graduate Profile during the hydroponic co-curricular activities are presented in Table 3, which shows a recap of the assessment of the critical reasoning dimension, cooperation dimension, and creativity dimension of students in the co-curricular activities with the theme of sustainable lifestyle. In accordance with government regulations, students are said to have a Graduate Profile if they are able to meet the criteria of Good (G) and Very Good (VG).

Table 3. Recapitulation of Assessment of Student Graduate Profile Dimensions

Assessment Indicators	Dimension		
	Critical Thinking	Collaboration	Creativity
Lacking (L)	0	0	0
Sufficient (S)	5	0	0
Good (G)	71	67	28
Very Good (VG)	36	45	84

(Source: Processed Data, 2026)

There are students who have not yet achieved the established Graduate Profile, specifically in the Good (G) category. This is evident in the Graduate Profile dimension of critical reasoning, where there are still 5 students at the Sufficient (S) stage. However, there are 71 students who meet the Good (G) criteria and 36 others who exceed the established standards, achieving the Very Good (VG) indicator in the critical reasoning dimension during hydroponic co-curricular activities. Students who are still at the developing stage in the critical reasoning dimension may be due to their low ability to find and seek solutions and decisions made collectively within the group. Students are less critical in seeking ideas and analysing the problems they encounter. This is evidenced by the issues encountered in the field where students did not create sources or examples of hydroponics and used newly purchased items. Students who had previously designed hydroponic containers did not strive to realise a sustainable lifestyle because they preferred to buy new items for hydroponic containers instead of processing plastic waste. The facilitator who provided guidance and direction to the students has confirmed this issue and found that the students neglected their responsibilities. Because the stage of making the hydroponic container is a one-day activity session, the students do not have enough time to search for plastic waste in the school environment that matches the design of the hydroponic container previously created together in their groups. On the other hand, when the students were asked to provide arguments for the action, those who were still at the developing stage were unable to provide reasons that supported their thoughts or views. This certainly causes students not to reach the Good (G) and Very Good (VG) stages set by the school, resulting in students remaining at the Sufficient (S) stage. Unfortunately, during this research, there has been no action taken to address the failure to meet the Graduate Profile standards in the critical reasoning dimension by the facilitators and the co-curricular team.

Although there are still students at the Sufficient (S) level in the critical reasoning dimension, all students have achieved the Graduate Profile in the collaboration and creativity dimensions. In the collaboration dimension, it is more dominated by the Good (G) stage, where 67 people reached the Good (G) creativity dimension, which is dominated by the Very Good (VG) stage. In the creativity dimension,

there are 84 people who have reached the Very Good (VG) stage, while the remaining 28 people are at the Good (G) stage.

Challenges and Findings of Co-curricular Activities

In addition to the issues found regarding the failure of some students to achieve the critical reasoning dimension of the Student Graduate Profile, several other problems were encountered by students during the implementation of hydroponic co-curricular activities. The first problem is the lack of understanding about hydroponics. Apart from the learners who do not have experience in hydroponics, it turns out that not all learners understand the concept of hydroponics. One of the causes is the lack of attention from the students during the training and presentation of hydroponic material. As a result, the students did not fully understand how to use rockwool media, leading to several groups experiencing problems with suboptimal plant growth and even crop failure. The second problem is with students who do not attend school during co-curricular activities. This, of course, becomes an obstacle for the group of students in carrying out the co-curricular activities. For example, during the stage of making hydroponic containers, there were students who were absent, which caused the group to be unable to immediately create the hydroponic containers because the hydroponic tools and materials, which were supposed to be distributed as individual tasks and responsibilities within each group, were not available. As a result, the students had to find the available tools and materials at the school themselves to attempt to make the hydroponic containers from recycled materials. The absence of these students also affects the hydroponic monitoring process. This happened because the plant monitoring schedule set by the group became problematic. Students who are absent must swap hydroponic monitoring schedules with students who are covering for them.

The third issue that arises is the cooperation among students. Even though peer assessment sheets have been provided, the issue of student inactivity is still found. There are members who are passive during co-curricular activities and only active during the action process. This issue has become a conflict within the group and has caused a sense of unfairness in working on the project. The fourth issue is related to the schedule for monitoring the plants. The monitoring process that runs for 40 days often clashes with student activities such as group study sessions, co-curricular activities, and students forgetting to do their duty. This causes the monitoring of the plants to become inconsistent and the hydroponics to potentially be neglected. The fifth problem is the weather and hydroponic location factors. There are students who choose hydroponic locations far from sunlight, and there are also students who choose locations that are too exposed to direct sunlight and rain because they are outdoors. As a result,

the hydroponic plants were damaged and experienced crop failure. If it can still be resolved, the students move the hydroponic location to a better place for the plants. The sixth problem is encountered during the presentation. Not all students have the confidence to present their project results in front of the class. This causes the delivery of the project message by the students to be less than optimal and not receive attention or feedback from other groups.

Besides the problems faced by students, there are several issues faced by teachers when they become facilitators of co-curricular activities. Facilitators have limited manpower and face difficulties in monitoring all students outside the classroom, especially when activities are conducted between groups in the class located far apart. The facilitator encounters students who are not active in heterogeneous work groups. One of the reasons is that the students are less comfortable collaborating with other individuals who are not their close friends, resulting in suboptimal contributions. The challenges in managing student groups also lead to increasingly subjective assessments of the collaboration dimension among students due to differences in student activity without considering individual conflicts within the group. The issue of assessing the Graduate Profile dimension also becomes one of the problems in co-curricular activities. The dimensions of collaboration and creativity are aspects that are difficult to assess objectively because they are based on process observation. Facilitators may experience doubt in providing assessments and tend to have subjective and inconsistent evaluations. Next, issues were found in the student reflection sessions, where the reflection activities did not fully align with the objectives of the activities. This means that the student reflections became less meaningful and were only carried out as a formality. This happens because the facilitator has limited ability to guide the students' reflection activities.

Another issue was found in the assessment of the critical value dimension, which did not receive feedback and attention from either the facilitator or the co-curricular team. The dimension of critical reasoning is still considered less than optimal and not meaningful for some students. This is reflected in five students who have not yet met the minimum criteria and are still at the developing stage. Students prefer using new containers instead of repurposing plastic bottles for hydroponics. This means that the students are less capable of analysing problems and finding solutions related to sustainability principles. This finding is further supported by the students' difficulty in providing arguments that support the choice of using new containers, indicating that the students have limitations in critical reasoning. This dimension of critical reasoning is also less meaningful and not yet optimal because there has been no improvement program from the school, so the value of critical reasoning has not been reinforced after the students' underachievement.

Impact of Co-curricular Activities

The hydroponic activities in the co-curricular program can be considered quite successful in instilling meaningful values of collaboration and creativity, but there are still challenges in instilling critical reasoning values. The indicators of success in the collaboration dimension can be seen from the achievement of development criteria as expected, with most being at a very developed stage. The collaboration of students is demonstrated through real collaborative practices such as task distribution, heterogeneous group work, and daily hydroponic monitoring sessions. The internalisation of the values of justice in collaboration and shared responsibility can be instilled through peer group assessments. Based on this, the value of collaboration is not only taught but also practiced directly and meaningfully in co-curricular activities. The dimension of creativity has success indicators with student achievement predominantly at the very advanced stage. Creativity in this activity is measured by the process of students creating hydroponic containers from recycled materials into new products that have been redesigned based on the exploration of ideas and original works of the students.

Nevertheless, the hydroponic co-curricular activities have an impact on improving students' understanding of food security, which can be reviewed before and after the project. Before participating in the activities, the students' understanding of the concepts of hydroponics and food security was still limited. Although the students have received training and materials, there are still technical difficulties in practice, such as difficulties in utilising rockwool media. This encourages them to seek instant solutions and continue experimenting with their hydroponic plants during co-curricular activities. After the activities took place, an increase in understanding was observed through the active involvement of students in the process of planting, caring for, and harvesting hydroponic vegetables directly. Some students were even able to overcome challenges such as limited planting locations and weather changes, making them more attentive and caring towards their hydroponics. Through this project, students began to directly understand the simple food production process, indicating an increase in food literacy.

These findings are in line with LeBlanc et al. (2022), which show that food literacy is highly correlated with the consumption of vegetables and fruits as well as healthy eating behaviours. Furthermore, good food literacy can also prevent obesity and improve academic performance (Doustmohammadian et al., 2020). School-based hydroponic activities are also associated with improved eating habits and mental health among adolescents, promoting a healthier lifestyle and greater satisfaction with green spaces (Kwok et al., 2021). Overall, these hydroponic activities foster awareness and interest among students regarding food issues. Students begin to strive to increase the supply of fresh

food in the school environment as a form of support and involvement in local food security (Shalahuddin et al., 2025). This tangible action is evident in the students' learning process, which includes hydroponic maintenance, understanding plant cycles, and the relationship between food, health, and ecology. This is in line with the views of Alwi et al. (2022) that hydroponics can serve as a practical tool in teaching environmental literacy, while also instilling awareness and resource management.

The hydroponic co-curricular activities in this study also have relevance to sustainable education goals within the SDGs. According to the research by Maisarah et al. (2023) hydroponic activities are strongly related to sustainable development and global challenges in line with the SDG goals. By enhancing knowledge of vegetable cultivation using hydroponic systems, skills can be improved, which highlights the importance of education as part of sustainable development in accordance with SDG 4 (quality education). In addition, hydroponic activities in the co-curricular program support SDG 12 regarding responsible consumption and production. Rajendran et al. (2024) explain that hydroponics contributes to resource efficiency and more responsible production practices. Where hydroponics encourages independent and sustainable food production by growing hydroponic vegetables with environmental limitations, without excessive pesticides, and water conservation, so that learners understand resource efficiency. Students are taught to utilise waste and recycle plastic waste and used materials as a real effort and practice of upcycling and waste reduction (Pambudi et al., 2022). Projects involving recycled materials for hydroponic systems encourage creativity and entrepreneurial spirit, further instilling sustainable practices in students' lifestyles. Engaging in hydroponics can also foster a sense of togetherness and collaboration among students, enhancing their overall well-being (Gusman et al., 2024). Based on the description, hydroponics that strengthen the Graduate Profile through the dimensions of critical reasoning, creativity, and collaboration in this research align with the sustainable development goals (SDGs).

Furthermore, the hydroponic activities in this study represent active and meaningful learning because students not only learn theory but also through direct experience. According to the research by H.-H. Wang et al., (2020) direct experience allows students to connect theory with everyday life. Additionally, direct experiences and activities through hydroponics can be the best learning strategy because good learning occurs when students truly apply their knowledge. Hydroponic co-curricular activities have also proven to be capable of developing 21st-century skills in students. The research results of Lisdiana et al. (2023) show that if students design, plant, monitor, and evaluate hydroponic results, it can demonstrate educational practices that encourage active and reflective engagement, thereby enabling students to develop creativity, initiative, and problem-solving skills. Furthermore, Maisarah et al. (2023); Pambudi et al. (2022); Rajendran et al. (2024) explain that through hydroponics, it is possible

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for individuals to practice and enhance farmers' skills such as knowledge and technical skills in hydroponic cultivation, managerial and marketing skills, as well as technology utilisation skills to optimise production.

This hydroponic co-curricular activity also demonstrates the school's role in supporting food literacy and a sustainable lifestyle. First, the school, through hydroponic co-curricular activities, becomes a real learning space for students to directly understand food issues. Research by Nasution & Gusti (2023) shows that if schools teach students to find solutions for producing vegetables amidst the limited land available at the school, this is considered relevant to the issue of food security in urban or densely populated areas. In addition, the school also teaches sustainability values by utilising waste materials and reducing waste. This is also in line with the research by Alwi et al. (2022) where schools become a real and meaningful learning medium in hydroponic activities, allowing students to actively understand the phenomena in their surrounding environment. Second, schools can become one of the agents of sustainable lifestyle change. Hydroponics conducted in schools can enhance food literacy, such as understanding the importance of food availability, sustainability, and quality by applying hydroponic cultivation technology (Rohman et al., 2025) thereby shaping students' perspectives on food security. In addition, schools promote the development of food independence, which is evident through the process of transitioning students' behaviour from consumption to production, as well as teaching care and active engagement with the surrounding environment (Nasution & Gusti, 2023). Hydroponic activities in schools also teach hydroponic vegetable cultivation as a means to realise healthy food cultivation practices (Alwi et al., 2022).

Conclusion

The implementation of the co-curricular program themed around sustainable lifestyles through hydroponic activities at SMA Katolik Karitas III Surabaya as an effort in food security education has been carried out systematically, structured, and comprehensively. This project has proven effective in facilitating the development of three dimensions of the Graduate Profile: critical reasoning, collaboration, and creativity through real learning experiences, although some issues were encountered during its implementation. The use of a clear activity flow, standardised report format, and authentic assessment system makes this project a model of good practice in the implementation of the Merdeka Curriculum, successfully integrating character education with sustainability and food security issues. Based on the findings of this research, there are several recommendations for future studies. First, researchers can review the long-term impact of hydroponic co-curricular activities on changes in students' behaviour and mindset related to sustainable lifestyles after the project is completed. The researcher conducts a long-

term impact evaluation of the project, not just as a school assignment but to see how it becomes a habit in the students' lives. Second, researchers can compare the effectiveness of hydroponic activities with other activities on the same theme to see which project model has the most impact. Third, researchers can conduct evaluative research involving in-depth interviews with students and teachers to explore perceptions and challenges, as well as requiring observations over a longer period to see the co-curricular impact.

References

- Abera, H. G. (2023). The role of education in achieving the Sustainable Development Goals (SDGs): A global evidence based research article. *International Journal of Social Science and Education Research Studies*, 03(01), 67–81. <https://doi.org/10.55677/ijssers/V03I1Y2023-09>
- Aliyah, S., Qudsiyah, M. I., & Huda, N. N. (2025). Implementasi Kegiatan Kokurikuler Di Pendidikan Anak Usia Dini Al-Islam Riyadhul Irfan Kecamatan Kadungora. *Jurnal Pendidikan Islam Anak Usia Dini (Anaking)*, 4(2), 99–106. <https://doi.org/10.37968/anaking.v4i2.1059>
- Alwi, M., Kudsiah, M., Hakim, A. R., Burhanuddin, B., & Maritasari, D. B. (2022). Penguatan literasi lingkungan melalui kegiatan Hidroponik untuk membangun green school di SDU Hamzanwadi. *ABSYARA: Jurnal Pengabdian Pada Masyarakat*, 3(2), Article 2. <https://doi.org/10.29408/ab.v3i2.5945>
- Arga, H. S. P. & Sapriya. (2024). Sustainable lifestyle project: An empirical study. In *Proceedings of the International Conference on Teaching, Learning and Technology (ICTLT 2023)* (Vol. 825, pp. 106–113). Atlantis Press SARL. https://doi.org/10.2991/978-2-38476-206-4_13
- Badan Standar, Kurikulum, dan Asesmen Pendidikan Kementerian Pendidikan, Kebudayaan, Riset, dan Teknologi Republik Indonesia. (2022). *Dimensi, Elemen, dan Subelemen Profil Pelajar Pancasila pada Kurikulum Merdeka*. Kementerian Pendidikan, Kebudayaan, Riset, dan Teknologi Republik Indonesia.
- Badan Standar, Kurikulum, dan Asesmen Pendidikan Kementerian Pendidikan, Kebudayaan, Riset, dan Teknologi Republik Indonesia. (2024). *Panduan Pengembangan Proyek Penguatan Profil Pelajar Pancasila Edisi Revisi*. Kementerian Pendidikan, Kebudayaan, Riset, dan Teknologi Republik Indonesia.
- Doustmohammadian, A., Omidvar, N., & Shakibazadeh, E. (2020). School-based interventions for promoting food and nutrition literacy (FNLIT) in elementary school children: A systematic review protocol. *Systematic Reviews*, 9(1), 87. <https://doi.org/10.1186/s13643-020-01339-0>
- Faizah, W. N. (2025). *Implementasi Kokurikuler Terintegrasi dalam Pembelajaran Seni Budaya di SD/MI Berbasis Kurikulum Merdeka*. 02(02).
- García-González, E., Albareda-Tiana, S., Solís-Espallargas, C., & Jiménez-Fontana, R. (2022). Transformative education for sustainable consumption. *Trends in Higher Education*, 1(1), Article 1. <https://doi.org/10.3390/higheredu1010001>

- Gell, L., & Paige, K. (2023). Solving Food Insecurity and Agricultural Challenges with Hydroponics. *Journal of Student Research*, 12(4), 1–8.
- Gusman, T. A., Hirawati, A. G., Khoirunniswati, K., Jayanti, D. D., Julaeha, E., Sahlan, M. Y., & Zakiyyah, Z. (2024). Design hidroponik sederhana dari botol bekas sebagai langkah kreatif dan ramah lingkungan di SMA Kartika XIX-3 Cirebon: Assembling simple hydroponics from wasted bottles as creative and environmentally friendly steps in senior high school. *PengabdianMu: Jurnal Ilmiah Pengabdian Kepada Masyarakat*, 9(4), Article 4. <https://doi.org/10.33084/pengabdianmu.v9i4.6730>
- Hartadiyati, E., Wiyanto, & Rusilowati, A. (2020). The compost tea on hydroponics system used to increase understanding of Sustainable Development for high school student in Adiwiyata program. *Journal of Physics: Conference Series*, 1567(2), 022060. <https://doi.org/10.1088/1742-6596/1567/2/022060>
- Kwok, S. W. H., Wu, C. S. T., Tong, H. T., Ho, C. N., Leung, K. L., Leung, Y. C. P., Lui, K. C., & Wong, C. K. C. (2021). Effects of the school-based integrated health promotion program with hydroponic planting on green space use and satisfaction, dietary habits, and mental health in early adolescent students: A feasibility quasi-experiment. *Frontiers in Public Health*, 9, 740102. <https://doi.org/10.3389/fpubh.2021.740102>
- LeBlanc, J., Ward, S., & LeBlanc, C. P. (2022). The association between adolescents' food literacy, vegetable and fruit consumption, and other eating behaviors. *Health Education & Behavior*, 49(4), 603–612. <https://doi.org/10.1177/10901981221086943>
- Lisdiana, H., Rahmawati, Y., Ridwan, A., & Hadinugrahaningsih, T. (2023). Development of 21st century skills through STEAM PjBL in the topic of salt hydrolysis and buffer solutions. *JKPK (Jurnal Kimia Dan Pendidikan Kimia)*, 8(2), 280–296.
- Maisarah, N. P., Fariyanti, A., & Rosiana, N. (2023). Sustainability of vegetable hydroponic system in Pekanbaru City. *Jurnal Manajemen Dan Agribisnis*, 20(2), 214–225. <https://doi.org/10.17358/jma.20.2.214>
- Mulu, M., Liana, D., Wahyu, Y., & Jarut, Y. (2024). Peningkatan pengetahuan siswa tentang budidaya tanaman melalui teknologi hidroponik sederhana. *JMM (Jurnal Masyarakat Mandiri)*, 8(4), 3655–3664.
- Nasution, R. N., & Gusti, U. A. (2023). Penerapan hidroponik tanaman kangkung dalam pembelajaran terhadap literasi kewirausahaan pada SMAN 3 Panyabungan. *Biology and Education Journal*, 3(2), 123–132. <https://doi.org/10.25299/baej.2023.14363>
- Nikmatullah, A., Haryanto, H., Nurrachman, Qomar, M., Apriani, A., Anton, Khotimah, H., Aulia, J., Rahman, A., & Rahman, F. (2023). Sosialisasi Pertanian Organik Sistem Hidroponik untuk Membangun Ketahanan Pangan Keluarga di Desa Meraran KSB. *Jurnal Pengabdian Magister Pendidikan IPA*, 6(3), Article 3. <https://doi.org/10.29303/jpmpi.v6i3.5261>
- Oktavia, N. T. (2024). Hidroponik sebagai pemanfaatan lahan kosong dalam pemenuhan kebutuhan pangan mandiri. *Community Service Journal Of Economics Education*, 3(1), 5. <https://doi.org/10.24014/csjee.v3i1.29682>

- Pambudi, Y. S., Gunawan, R. I., Lolo, E. U., Sudaryantiningsih, C., Krismani, A. Y., Widiyanto, Banoet, M. Y., Amah, V. T., Jama, J. T., & Ngaling, A. D. (2022). Hydroponic training as an effort to improve food security, community economy, and environmental quality in the city of Surakarta. *Asian Journal of Community Services*, 1(5), 251–260. <https://doi.org/10.55927/ajcs.v1i5.1841>
- Rajendran, S., Domalachenpa, T., Arora, H., Li, P., Sharma, A., & Rajauria, G. (2024). Hydroponics: Exploring innovative sustainable technologies and applications across crop production, with Emphasis on potato mini-tuber cultivation. *Heliyon*, 10(5), e26823. <https://doi.org/10.1016/j.heliyon.2024.e26823>
- Rohman, F., Saputra, R., Rasinta, I., Viyona, M., Daulay, D. P., Aini, L., Indriyani, I., Pratama, Y. Z., Fortuna, D., Lisani, L., & Tafzi, F. (2025). Pelatihan hidroponik sebagai upaya pemberdayaan generasi z dalam mendukung ketahanan pangan berkelanjutan. *JDISTIRA - Jurnal Pengabdian Inovasi Dan Teknologi Kepada Masyarakat*, 5(2), Article 2. <https://doi.org/10.58794/jdt.v5i2.1438>
- Saini, M., Sengupta, E., Singh, M., Singh, H., & Singh, J. (2023). Sustainable Development Goal for quality education (SDG 4): A study on SDG 4 to extract the pattern of association among the indicators of SDG 4 employing a genetic algorithm. *Education and Information Technologies*, 28(2), 2031–2069. <https://doi.org/10.1007/s10639-022-11265-4>
- Shalahuddin, I., Rosidin, U., & Pebrianti, S. (2025). The green school movement is promoting food security through hydroponics at SMP Negeri 1 Rancaekek. *ABDIMAS: Jurnal Pengabdian Masyarakat*, 8(1), 698–705. <https://doi.org/10.35568/abdimas.v8i1.6166>
- Shilviana, K., & Hamami, T. (2020). Pengembangan Kegiatan Kokurikuler dan Ekstrakurikuler. *PALAPA*, 8(1), 159–177. <https://doi.org/10.36088/palapa.v8i1.705>
- Sousa, R. de, Bragança, L., da Silva, M. V., & Oliveira, R. S. (2024). Challenges and solutions for sustainable food systems: The potential of home hydroponics. *Sustainability*, 16(2), Article 2. <https://doi.org/10.3390/su16020817>
- Suharno, S., Farmawaty, F., Rahayu, I., Budi, R. S., Sujarta, P., Chrystomo, L. Y., & Suyono, Ign. J. (2023). Pelatihan usaha budidaya tanaman sayuran dengan teknik hidroponik. *Bakti Hayati: Jurnal Pengabdian Indonesia*, 1(2), 54–59. <https://doi.org/10.31957/bhjpi.v1i2.2512>
- Tim Kegiatan Kokurikuler SMA Katolik Karitas III Surabaya. (2025). *Modul Projek Penguatan Profil Pelajar Pancasila Tema Gaya Hidup Berkelanjutan*. SMA Katolik Karitas III Surabaya.
- Wang, H.-H., Charoenmuang, M., Knobloch, N. A., & Tormoehlen, R. L. (2020). Defining interdisciplinary collaboration based on high school teachers' beliefs and practices of STEM integration using a complex designed system. *International Journal of STEM Education*, 7(1), 3. <https://doi.org/10.1186/s40594-019-0201-4>
- Wang, O., Deaker, R., & Van Ogtrop, F. (2025). A systematic review of food-waste based hydroponic fertilisers. *Agricultural Systems*, 223, 104179. <https://doi.org/10.1016/j.agsy.2024.104179>
- Widowati, W., Hidayat, J. W., Hariyanto, S., Triyana, E., Ariyani, R. C. A., Wardhani, R., & Permatasaro, T. A. (2023). Pemberdayaan masyarakat melalui pelatihan teknologi hidroponik untuk ketahanan pangan. *Jurnal Pasopati*, 5(4). <https://doi.org/10.14710/pasopati.2023.20580>

- Yuliana, A. I., Nashoih, A. K., Mathoriyah, L., Salsa, N. F., & Yanuardi, H. (2024). Pelatihan Sistem Hidroponik di Lahan Sempit Sebagai Upaya Menjaga Ketahanan Pangan Keluarga di Desa Ngogri Megaluh Jombang. *Jumat Pertanian: Jurnal Pengabdian Masyarakat*, 5(1), Article 1. <https://doi.org/10.32764/abdimasper.v5i1.4325>
- Zega, Y. K., Simanjuntak, H., Sijabat, P. M., Hutabarat, M., Sinaga, R., Togatorop, S., & Harefa, S. (2023). Membangun lingkungan hidup melalui tanaman hidroponik di SMP Eppata 2 Batu Aji. *Jurnal Pengabdian kepada Masyarakat Nusantara (JPkMN)*, 3(2), 1945–1950.