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RESEARCH ARTICLE

Early Childhood Agricultural Learning Through Tree Walks and Hydroponics: A Soil Science Extension Case Study

Izzah Abd Hamid[1], Wan Asrina Wan Yahaya[2*]

[1]Department of Crop Science, Faculty of Agricultural and Forestry Sciences, Universiti Putra Malaysia Sarawak, 97008 Bintulu, Sarawak, Malaysia
Email: izzahabdhamid@gmail.com
[2]Department of Crop Science, Faculty of Agricultural and Forestry Sciences, Universiti Putra Malaysia Sarawak, 97008 Bintulu, Sarawak, Malaysia
Email: asrina@upm.edu.my

CORRESPONDING AUTHOR (*):
Wan Asrina Wan Yahaya
(asrina@upm.edu.my)

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ABSTRACT

Early exposure to agriculture and the environment helps children develop a basic awareness of nature, food systems, and sustainability. This study examined how two hands-on activities, (1) tree walk and (2) simple hydroponic planting session, shaped preschool children's understanding of plants, their environmental roles, and sustainable practices. The programme, conducted in Bintulu, Sarawak, involved 40 children aged 4 to 6 from two local kindergartens. Before and after the activities, simple picture-based surveys was used to assess their recognition of tree species, plant categories, and basic hydroponic concepts. The results showed that children were able to name trees, recognise benefits such as soil health and food provision, and explain that plants in hydroponics grow using nutrient water. Most of the children said they enjoyed the activities and wanted to try similar planting at home. The use of familiar crops made the activities easier for children to understand and recall. These findings show the value of incorporating simple agricultural activities in early education and highlight how soil scientists can contribute through child-friendly outreach programmes.

Contribution/Originality: This case study explores a rarely reported approach in Malaysia, combining tree walks and hydroponic planting for preschoolers in Bintulu. It highlights how soil scientists can contribute to early education and shows that playful, age-appropriate methods can effectively introduce children to plant, soil, and environmental sustainability concepts.

1. Introduction

Rising environmental pressures such as biodiversity loss and climate change have made early education in sustainable practices increasingly important. Today's children are growing up in urbanising societies where direct exposure to farming, forestry, and soil-based ecosystems is becoming less common. As a result, many children lack basic awareness of how food is grown, how trees support ecosystems, and how soil and water sustain life. This decline is sometimes called the "extinction of experience" (Soga and Gaston, 2016). Such a lack of awareness may reduce future interest in sustainable practices and environmentally responsible decision-making. Research indicates that meaningful learning begins when young children engage directly with the environment (Rakesh et al., 2024). In this context, integrating agricultural concepts into early childhood education is not only valuable for environmental sustainability but also for public engagement with soil and plant sciences.

For soil scientists, this situation is both a challenge and an opportunity. Traditionally soil science focused on research and technical extension to farmers, but its influence could be broadened through participation in educational initiatives targeted to children. While agricultural extension programmes typically involve adult learners and farming communities, early childhood exposure to soil and plant knowledge, when appropriately tailored, can plant seeds of interest and understanding long before formal schooling introduces such concepts. Even simple lessons on soil health, plant nutrition, and environmental care can be taught to young children through hands-on, play-based learning (Ogelman, 2012).

1.2. Malaysian Educational and Environmental Context

Malaysia is rich in biodiversity and agricultural resources, with agroforestry, plantations, and smallholder systems forming a backbone of rural and semi-urban economies. Within the formal education system, agriculture is generally introduced at the secondary level through subjects such as integrated science, agricultural science, or vocational electives. At the preschool level, the *Kurikulum Standard Prasekolah Kebangsaan* (KSPK) provides thematic learning areas that include basic environmental awareness within its science and technology strand. However, as noted by Rahmatullah et al. (2021) in their review of early childhood care and education in Malaysia, most environmental content is delivered indoors through teacher-centred approaches, with limited structured outdoor or community-based learning activities.

In Sarawak, where this study was conducted, many children have informal exposure to nature but limited structured opportunities to learn about agriculture or forestry within an educational context. Despite the state's abundant tropical forests and agricultural land, there are few formal initiatives specifically aimed at preschool children to build foundational knowledge of plants, soils, and ecosystem services. This gap presents opportunities for community-based extension activities, particularly those designed with soil science and plant ecology as core elements.

1.3. The Role of Experiential Learning

Experiential learning is widely recognised as a powerful educational approach. Kolb (1984) theory outlines how learners progress through concrete experience, reflective observation, abstract conceptualisation, and active experimentation. For children aged 4 to 6 which the focus group of this study showed experiences must be sensory, play-based, and structured within their cognitive abilities. Activities such as touching soil, planting seeds, observing tree shapes, and mixing nutrient water allow children to construct knowledge from real-world interactions. Furthermore, when guided by facilitators trained in plant and soil sciences, these experiences become valuale opportunities for early scientific inquiry.

Hydroponic planting, offers a modern, space-efficient method of growing plants without soil, introducing children to alternative food systems that are increasingly relevant in urban and peri-urban settings. Combining hydroponics with a tree awareness walk provides a dual perspective, including one rooted in traditional ecological knowledge and the other in contemporary agricultural innovation.

1.4. Community-Based Extension and the Role of Soil Scientists

This project was conducted as part of a community-based extension activity at Taman Tumbina Bintulu, a botanical and recreational park. The aim was not only to expose children to environmental knowledge but also to explore how soil scientists and agricultural professionals can contribute meaningfully to early education. Extension activities in soil science are often overlooked by young learners. However, adapting scientific knowledge into visual and experiential formats for young children allows professionals to contribute to lifelong learning pathways.

The tree and hydroponic activities were designed around age-appropriate surveys, pictorial cards, and play-based observation. These methods ensured engagement while also generating quantifiable data on children's understanding before and after the activities. The combination of structured surveys and open-ended feedback from children helped capture shifts in knowledge and perceptions.

1.5. Study Objectives and Significance

This study aimed to evaluate how experiential activities, such as tree walks and hydroponic planting, can enhance understanding of plants, the environment, and agricultural practices among kindergarten-aged children in Bintulu, Sarawak. Specifically, the objectives were:

i. To explore how experiential agricultural activities influence early childhood (4–6 years old) understanding of plant functions, nutrient needs, and environmental roles.
ii. To assess the effectiveness of hydroponics and tree-based activities as tools for early agricultural education and soil-related extension.

By focusing on this age group, the study addresses a rarely explored intersection between soil science, plant education, and early childhood pedagogy. Furthermore, the findings serve as a practical reference for designing future outreach programmes involving young learners, especially within Malaysian and tropical contexts.

The study is significant for three key reasons. First, it offers insights into how young children conceptualise plant life and environmental care following guided exposure. Second, it supports the role of soil scientists in community education beyond conventional boundaries. Third, it contributes to the growing body of literature advocating for the earlier integration of sustainability and agricultural awareness into preschool settings.

2. Literature Review

2.1. Early Childhood Learning and Environmental Awareness

Early childhood is a critical stage for shaping cognitive, emotional, and behavioural foundations that persist into adulthood. Environmental education at this age fosters pro-environmental attitudes, empathy towards nature, and early scientific reasoning (Lamanauskas, 2023; Mousavi et al., 2024). Research shows that children who engage directly with nature, rather than only hearing about it in class, are more likely to develop lasting concern for the environment (Gong & Li, 2024).

In Malaysia, the National Preschool Standard Curriculum (KSPK) recognises the importance of moral and environmental values but offers limited strategies for experiential delivery (Ministry of Education Malaysia, 2017). The intentional integration of agricultural and environmental activities can strengthen environmental literacy while also supporting broader developmental domains such as cognitive growth, language, and socio-emotional skills (Ardoin & Bowers, 2020; Watt & Frydenberg, 2025).

2.2. Experiential and Play-Based Learning in Agriculture

Experiential learning, as defined by Kolb (1984), progresses through concrete experience, reflection, conceptualisation, and experimentation. For children in Piaget's preoperational stage (ages 2–7), learning is most effective through symbolic play, imitation, and hands-on activities (Tosolini et al., 2025). Activities involving plants, trees, soil, and water make scientific concepts tangible at this stage.

Informal learning environments such as gardens, parks, and community centres provide flexible, context-rich opportunities that complement formal education (Falk & Dierking, 2000). In agriculture, participatory approaches allow learners of all ages to engage directly with knowledge systems. Globally, play-based agricultural initiatives have shown positive impacts. In Kenya, the FAO-supported "Farm to School" model integrates small-scale farming into primary education to improve dietary diversity and ecological awareness (Food and Agriculture Organization of the United Nations, 2021). In Indonesia and the Philippines, school and community gardens have enhanced nutrition and food security, although many programmes emphasise dietary outcomes rather than environmental science or soil literacy.

2.3. Hydroponics as an Educational Tool

Hydroponics, once mostly linked to urban farming, is now used in classrooms because children can directly observe the roots, water, and nutrients. This makes the growing process more transparent and easier to understand (Jon Schneller et al., 2015; Rajaseger et al., 2023). Classroom studies show that hydroponics can increase student engagement and retention of biological concepts (Almerino and Peria, 2024), while also fostering environmental responsibility, plant-care confidence, and sustainable practices.

For younger learners, simplified kits using recycled bottles, sponge cubes, and coloured nutrient solutions offer sensory stimulation while introducing nutrient balance and root health (Jon Schneller et al., 2015). In Malaysia, most hydroponics outreach activities are directed at upper primary and secondary schools through science clubs and competitions. Early childhood inclusion, particularly through play-based community programmes, remains rare (Rajaseger et al., 2023).

2.4. Trees and Ecosystem Understanding Among Children

Trees are a strong teaching tool because they show biodiversity, the interdependence o living organisms, and the role of vegetation in sustaining life. Activities such as leaf-touching, canopy observation, and fruit or flower identification help children classify plants and understand their functions. Green schoolyards have been linked to stress recovery, greater engagement with nature, and positive environmental attitudes (Chawla et al., 2014).

Nature-based preschool programmes significantly increase children's responsibility towards nature compared with conventional settings (Savolainen, 2021). Experimental studies show that nature-contact education improves behaviours such as waste sorting, advocacy, and water conservation (Zhao et al., 2024). Futhermore, connectedness to nature has been linked to prosocial behaviour and psychological well-being (Sobko et al., 2018; Putra et al., 2020).

Classification activities, for example, grouping trees as fruit-bearing, shade-giving, or poisonous, support the development of foundational biological categorisation skills. When paired with storytelling, visual aids, or guided walks, these activities embed ecological concepts in lived experiences. In Malaysia, botanical gardens like Taman Tumbina provide rich plant diversity but lack structured preschool outreach. Child-focused trails with simple language and visuals could greatly enhance educational value.

2.5. The Role of Soil Scientists in Early Extension and Education

Soil science was once regarded as a technical discipline, but it is now recognised as important for public understanding. Both FAO and IUSS stress the importance of soil literacy from an early age (Food and Agriculture Organization of the United Nations, 2015). Early lessons might include simple concepts such as "plants get food and water from soil" or "healthy soil helps trees grow".

While extension programmes often prioritise adult audiences, children represent future land stewards. Simple demonstrations such as comparing healthy and degraded soils, or showing how soils hold water can make soil concepts easier for children to grasp. Incorporating hydroponics alongside soil-based lessons can further illustrate plant growth requirements. In Malaysia, youth-focused soil outreach is largely confined to events such as World Soil Day and science fairs, which often lack sustained engagement. Government–university collaborations could address this gap by integrating soil education into preschool extension activities. As Hartemink (2008) emphasises, soil education must begin "from the ground up".

2.6. Summary of Gaps and Justification for Current Study

Despite strong global evidence supporting early agricultural and environmental education, Malaysian research on preschool engagement with structured tree- and hydroponic-based learning remains scarce. The key gaps include:

i. Limited involvement of soil scientists in preschool programme design and delivery
ii. A lack of pictorial and verbal surveys to assess young children's learning outcomes

iii. Few studies combining traditional (tree-based) and modern (hydroponic) approaches within a single programme
iv. Minimal research situated in rural or semi-urban contexts like Bintulu, Sarawak

This study addresses these gaps through a dual-activity model developed and delivered by agricultural professionals, using age-appropriate tools to assess children's perceptions of environmental categories, plant needs, and sustainability concepts.

3. Research Methods

This study used a quantitative descriptive design, with open-ended questions included in the surveys to allow children to explain their reasoning. The study was conducted in Bintulu, Sarawak, Malaysia, and involved 40 children aged 4 to 6 from two kindergartens, which are: Permata Kasih and Penyayang Mama. The children were accompanied either by their teachers or, in the case of the younger ones, by family members.

The activity formed part of a community-based extension programme held at Taman Tumbina, Bintulu, designed to raise awareness about trees and introduce hydroponic planting using recycled materials. The programme combined outdoor exposure, hands-on planting, and guided participation to help children build an early understanding of plants, the environment, and sustainable agriculture. The target population was children aged 4 to 6 attending kindergartens in Bintulu, selected because they were available and allocated by the kindergartens for the weekend programme.

The total sample size was 40 children, with 20 from each kindergarten, determined by the allocation provided by the kindergartens. This convenience sampling was considered appropriate for descriptive analysis of this age group. The total sample of 40 children (20 per kindergarten) was based on the number of children approved and allocated by the kindergartens for participation in the weekend programme. Once consent was obtained between the kindergarten and the teachers, 20 children from each kindergarten were accepted. This sample size also allowed for manageable facilitation, as the children could be divided into two groups for activities and data collection.

Two structured survey forms were developed to assess the children's understanding before and after the learning activities:

i. Survey 1: Tree and Environment Awareness (Pre-Activity)
ii. Survey 2: Hydroponic Planting Experience (Post-Activity)

The surveys used simple, picture-based questions suited for young children. Some parts included coloured cards showing vegetables or liquids, allowing children to answer by pointing rather than reading. Open-ended questions were included to allow children to provide explanations for their answers. Each survey contained:

i. Section A: Demographics (ethnicity, age, kindergarten, gender)
ii. Section B: Understanding of the activity, using both verbal and visual inputs

The instruments were designed in Malay, piloted, and refined before full implementation. The survey was piloted with 20 undergraduate students to evaluate whether the questions were clear and suitable for young children. The students were asked to respond as a child might and to provide feedback on the clarity of wording, flow, and use of pictures.

Following their feedback, minor adjustments were made to the layout and language, particularly to improve the accuracy of visual cues and to simplify facilitator instructions.

The activity day was divided into two main segments:

i. Tree and Environment Activity (Morning)

Children were divided into two main groups, each was assigned to one of two rotating activity teams, ensuring a manageable facilitator-to-child ratio (approximately 1 extension facilitator per 4 children, supported by undergraduate students). Participants were taken on a guided walking tour through Taman Tumbina's botanical areas, where they were introduced to a range of tree species and their environmental significance.

Approximately 30 minutes after returning from the environmental walk, selected children were invited to complete Survey 1. Trained facilitators read the questions aloud to each participant, explained unfamiliar terms, and allowed children to respond either verbally or by pointing to pictures.

Only one group completed Survey 1 at a time to reduce fatigue and maintain engagement. Responses were recorded using both closed- and open-ended questions to capture children's reasoning.

ii. Hydroponic Activity (Afternoon)

After lunch, all children participated in a hands-on hydroponic planting session using recycled containers and a simplified nutrient solution. The session introduced basic hydroponic concepts and allowed participants to plant leafy vegetables (e.g., mustard greens).

Approximately 30 minutes after the hydroponic session, all participants were invited to complete Survey 2. This session used colour picture cards to support the question prompts. Children were assisted by facilitators where needed and were encouraged to respond based on their observations and experiences. Responses were recorded using both closed- and open-ended questions.

Descriptive data analysis was performed. The total count and percentage for each response were calculated. Graphical representations of the data were generated using SigmaPlot 14.0.

Given the young age of participants, ethical measures were carefully applied. Verbal consent was obtained from teachers or guardians prior to participation. No formal institutional ethical approval was obtained due to the educational and low-risk nature of the programme. All questions were designed to be playful and age-appropriate, no personal details were collected, and children were free to withdraw at any time.

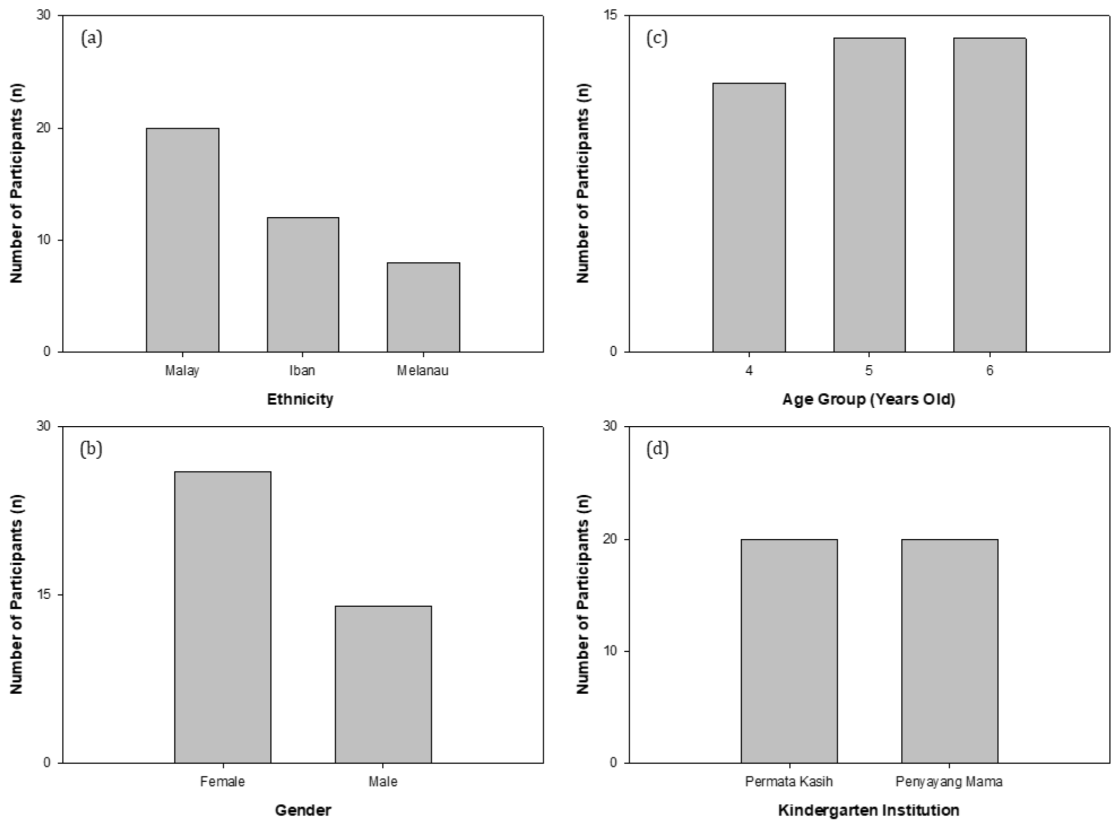
Photographs or videos, if taken, were handled by the organising team with parental awareness and in accordance with standard guidelines of school visits.

4. Results

4.1. Participant Demographics

Forty children aged 4 to 6 took part: 20 from Permata Kasih and 20 from Penyayang Mama. The group comprised 26 girls and 14 boys. The group included Malay (20), Iban (12), and Melanau (8) children, providing a balanced mix of gender and local ethnic groups, as shown in Figure 1.

Figure 1: Demographic characteristics of study participants



4.2. Survey 1: Tree and Environmental Awareness

The children's awareness of trees and their functions was assessed through structured verbal and pictorial prompts, and the results are presented in Table 1. When asked to name trees they recognised, Allamanda (n = 13) emerged as the most frequently recalled species, followed by Bougainvillea and Bird's Nest Fern (n = 9 each). Other species mentioned included the *Kuini* Mango Tree and the Crab Claw Flower (n = 7 each), with fewer references to plants such as the Golden Shower Tree and Fan Palas. Children most often remembered brightly coloured or decorative trees, indicating that strong visual features influence recall at this age.

The children were also able to classify tree types using pictorial category cards, as presented in Table 2. The most frequently identified categories were fruit trees (n = 16) and ornamental plants (n = 15), forest or timber trees (n = 7), and poisonous plants (n = 7). A smaller number of children identified herbal and shade trees (n = 5 each). These findings indicate that children were more familiar with plant types commonly encountered in their daily life or at home, such as fruit-bearing and decorative species.

Table 1: Tree species mentioned by children during the tree awareness activity (top 10 responses)

Tree Name	Number of Mentions
Allamanda / Yellow Bell	13
Bird's Nest Fern (*Asplenium nidus*)	9
Bougainvillea	9
Crab Claw Flower (*Heliconia* spp.)	7
Kuini Mango Tree (*Mangifera odorata*)	7
Lobster Claw	6
Golden Shower Tree (*Cassia fistula*)	5
Fan Flower (*Scaevola* spp.)	5
Fan Palas (*Licuala* spp.)	5
Spider Lily (*Hymenocallis* spp.)	5

Note: Children were allowed to name up to three tree species. Spelling was interpreted based on visual or verbal recognition

Table 2: Tree categories recognised by participants (multiple responses allowed)

Tree Category	**Frequency**
Fruit trees	16
Ornamental plants	15
Forest/timber trees	7
Poisonous plants	7
Herbal plants	5
Shade trees	5

Note: Multiple selections were allowed per participant using category cards. Categories were explained using visuals

Many children said that trees make the surroundings beautiful (16 mentions). Others noted their role in food provision (12), soil health (12), cooling (10), oxygen (9), and soil stability (9), as summarized in Table 3. These answers suggest that the children were beginning to associate trees with different environmental roles, likely supported by what they saw and heard during the walk.

Table 3: Perceived environmental benefits of trees as identified by children

Environmental Benefit	**Frequency**
Beautify the surroundings	16
Trees provide food	12
Maintain soil health	12
Cool the air	10
Provide oxygen	9
Strengthen the ground	9

Note: Responses were recorded based on participant recall after the environmental walk. Up to 3 responses per child

Environmental responsibility was also assessed through a behavioural question regarding conduct in botanical gardens. Thirteen children stated that one should not pick leaves or flowers during visits, while seven gave incorrect responses, as summarized in Table 4. This result suggests that the majority were able to grasp the ethical dimension of plant conservation and appropriate behaviour in public spaces after the activity.

Table 4: Participant awareness regarding conduct in the botanical garden

Response Option	Frequency
No, we should not pick flowers or leaves	13
Yes, we can pick flowers or leaves	7

Note: Question focused on environmental responsibility. Most children showed awareness of appropriate garden behaviour

4.3. Survey 2: Hydroponic Planting Experience

All 40 children participated in the hydroponic planting activity, using recycled containers and a simple nutrient solution. Afterwards, every child reported enjoying the session, showing that they were engaged and interested (Figure 2). In addition, 38 children (95%) reported a willingness to repeat the activity at home, reflecting strong motivation to apply the learning independently (Figure 3).

Figure 2: Children's enjoyment of the hydroponic activity

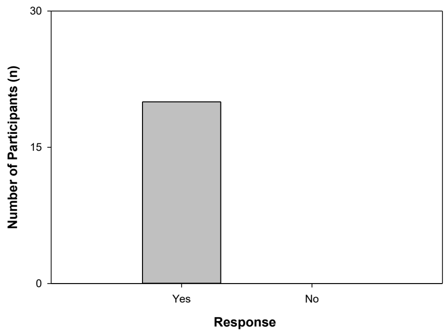
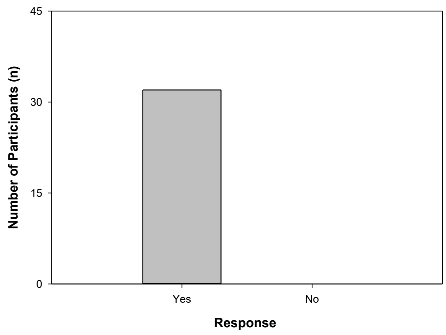


Figure 3: Willingness to continue hydroponic planting at home



To assess familiarity with the planted crop, children were shown image cards of common leafy vegetables. Eighteen correctly identified mustard greens (*sawi*) as a plant they had seen before (Figure 4a), and 17 reported having eaten it (Figure 4b).

One child selected Chinese kale (kailan), while none chose cabbage or water spinach (Table 5). The high level of recognition for mustard greens reinforces the effectiveness of using culturally and locally familiar plants in educational contexts.

Figure 4: Familiarity with the hydroponic vegetable among participants

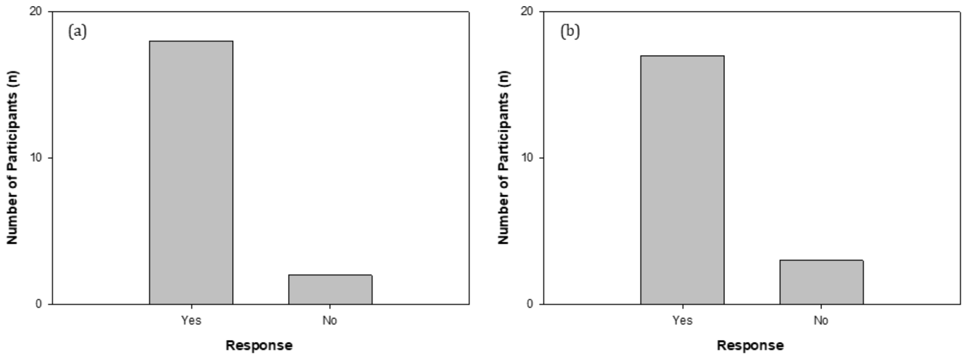


Table 5: Vegetable species identified by participants

Vegetable Name	Frequency
Mustard greens *(Sawi)*	19
Chinese kale *(Kailan)*	1
Cabbage *(Kubis)*	0
Water spinach *(Kangkung)*	0

Note: Identification was done using picture cards. One answer was recorded per participant

Children were also asked to share reasons for enjoying the hydroponic activity. Children said they enjoyed the session because they learnt a new way to plant (4 mentions) or found it fun (4 mentions). Others mentioned gaining knowledge (3), making friends (2), or wanting to eat the vegetables (2) (Table 6). These answers show that the activity was not only enjoyable but also gave them new ideas and experiences.

Table 6: Reasons participants enjoyed the hydroponic planting activity

Reason	Frequency
Learned to plant in a different way	4
Fun	4
Got to know more about plants	3
Learned new things	3
Learned how to grow plants hydroponically	2
Made new friends / Strengthened friendships	2
Because I can eat the vegetables	2

Note: Open-ended responses were grouped thematically. Responses were collected orally post-activity

To test their understanding of nutrient delivery, children were asked which liquid had been used in the hydroponic activity. All 20 who answered selected 'fertiliser water', with none choosing tap, drain, or drinking water (Table 7). This shows that hands-on practice, supported by clear explanations and visuals, helped them remember the concept.

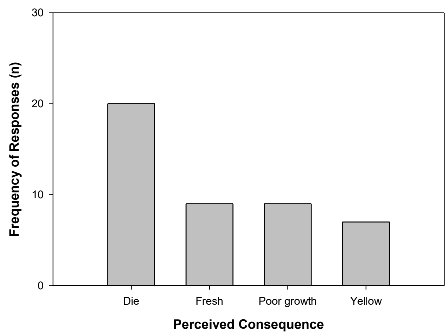
Further understanding of plant care was assessed using visual cards showing the effects of water shortage. Most children selected outcomes associated with insufficient water supply, including plant death, yellowing leaves, or drying symptoms (Figure 5). These selections suggest an emerging awareness of plant health dependencies and cause-effect reasoning, even at the early childhood level.

Table 7: Type of water or liquid used in the hydroponic activity

Type of Water or Liquid	Frequency
Fertiliser water	20
Tap, drain, or drinking water	0

Note: Note: All children accurately identified the correct hydroponic solution after demonstration and discussion

Figure 5: Understanding of consequences of insufficient hydroponic water supply



5. Discussion

This study evaluated the impact of experiential environmental and agricultural activities on children aged 4 to 6 through structured exposure to tree walks and hydroponic planting. The findings demonstrate that young learners were not only able to recall plant species and categorise trees but also understood basic plant–environment interactions and nutrient concepts. These outcomes confirm the effectiveness of combining hands-on activities with visual aids and guided facilitation to enhance early childhood agricultural learning.

5.1. Addressing Objective 1: Understanding of Plant Functions, Nutrient Needs, and Environment

Children were able to name species such as Allamanda, Bougainvillea, and Bird's Nest Fern, showing that the tree walk helped trigger memory and visual learning. They most often recalled ornamental and fruit trees, which suggests that young learners respond best to plants with striking shapes, colours, or everyday uses. Moreover, when prompted to describe environmental benefits of trees, responses such as "beautify the surroundings", "provide food", and "maintain soil health" were consistently recorded. This indicates not only retention but also comprehension of ecological roles, especially when reinforced through guided observation.

It was noteworthy that some children mentioned soil-related functions such as "keeping soil healthy" or "making the ground strong", as these are usually abstract ideas at this age. Their responses show that soil concepts can be taught to young children if explained with clear examples and hands-on activities. This aligns with the findings of Nguyen and Walters (2024) and Liu and Green (2023), who emphasised the value of direct nature contact in developing environmental cognition among children.

Children's behavioural awareness, as shown by 13 out of 20 stating that picking plants in a botanical garden is inappropriate, further demonstrates that environmental responsibility can be instilled early. This supports van de Wetering et al. (2022) that experiential learning promotes not only knowledge but also positive attitudes toward environmental ethics.

5.2. Addressing Objective 2: Evaluating Hydroponics and Tree-Based Activities as Educational Tools

The hydroponic activity also proved effective. All of the children said they enjoyed it, and most expressed a desire to try planting again at home. All of the children stated that the plants grew with fertiliser water. This shows that simple, hands-on learning with visual support helped them remember even new words. Furthermore, participants were able to articulate logical consequences of inadequate water supply, including symptoms such as dryness or plant death, reflecting an early understanding of plant physiological needs.

The fact that most children had previously seen or consumed mustard greens reflects the pedagogical advantage of selecting crops that are both culturally familiar and dietarily relevant. Incorporating such familiar leafy vegetables in hydroponic activities helps bridge the gap between children's home environments and classroom learning. This connection enhances engagement, reinforces recognition, and supports knowledge retention. Malaysian studies on hydroponic education among primary students, along with practical school-based programmes, have demonstrated that cultural relevance significantly improves children's understanding of sustainable agriculture (Kwok et al., 2021).

Children gave different reasons for enjoying the session. These include trying a new way of planting, having fun, learning something new, or wanting to eat the vegetables. These responses suggest the activity provided both enjoyment and knowledge. They reflect the interplay between cognitive gain, curiosity, and emotional satisfaction, key elements of Kolb (1984) experiential learning theory. Additionally, their interest in repeating the activity indicates the potential for sustained engagement if such interventions were incorporated into routine pre-school curricula or community outreach.

Together, the tree walk and hydroponic session offered a good balance. The walk provided children with a sense of natural ecosystems and biodiversity, while the hydroponics introduced a modern way of growing plants in a simple format. Together, they exposed children to both traditional and contemporary agricultural contexts.

5.3. Implications for Soil Science Extension

The findings suggest that soil and plant scientists can play a bigger role in early education, especially by creating activities that are simple and suitable for young children. Although extension services traditionally focus on adult or professional audiences, this study shows that scientific knowledge, particularly related to soil, nutrients, and plant function, can be effectively simplified and communicated to pre-school children. Visual aids, recycled materials, and real-time demonstrations proved particularly effective in translating scientific concepts into meaningful experiences.

By engaging with young children in this way, soil scientists can help establish early foundations for environmental literacy and agricultural awareness. Such initiatives also foster public trust in science and promote long-term sustainability by nurturing responsible attitudes from an early age. Future programmes could also include soil-focused activities, such as composting, feeling different soil textures, or observing roots, using the same playful and hands-on approach.

6. Conclusion

This study shows that simple activities such as tree walks and hydroponic planting can help children as young as four to six learn about plants and the environment. The children were able to recall plant species, group trees into types, describe environmental roles, and explain basic hydroponic ideas such as nutrient sources and the consequences of insufficient water. These outcomes confirm that young learners are capable of grasping key concepts in plant science and sustainability when exposed through structured, age-appropriate methods.

Both activities successfully maintained children's engagement, and many wanted to continue learning at home. The use of culturally familiar crops also made the lessons easier to understand and more relatable.

In conclusion, this study shows that early childhood agricultural education can be an effective extension approach. Simple activities such as tree walks and hydroponic planting can build environmental literacy and plant science awareness among preschoolers. Soil scientists and agricultural professionals are encouraged to contribute to community-based programmes for young learners, helping to strengthen early foundations for sustainability and soil awareness.

Ethics Approval and Consent to Participate

No formal institutional ethics approval was obtained for this study because the activity was part of a low-risk educational community programme. All procedures involving human participants were conducted in accordance with standard ethical guidelines for research with young children. Verbal consent was obtained from teachers or guardians prior to participation, and children were free to withdraw at any time. No personal identifiers were collected, and all questions were age-appropriate and non-intrusive.

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Conflict of Interest

The authors reported no conflicts of interest for this work and declare that there is no potential conflict of interest with respect to the research, authorship, or publication of this article.

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