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Sustainability Communication through Bio-Based Experiential Learning

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Abstract: Sustainability-related communication involving youth and children continues to be difficult to practice effectively and sustainably. This study examines how effective a particular approach to sustainability communication is at raising children's environmental awareness through an educational program. Participatory action research and storytelling as a narrative paradigm were used to examine the effectiveness of bio-based experiential learning. A total of 74 students (ages 9 to 11) from Bandung, Indonesia, participated in the program. Twenty parents also participated in providing feedback for the campaign on how to change their children's behavior towards the environment. The outcome demonstrates that the communication approach of bio-based experiential learning activities provides children with valuable education. The children are taught about urban farming, environmental awareness, and social responsibility. In the long run, it is hoped that children will be motivated to start an environmentally friendly business, particularly in biotechnology for the environment, to foster a sustainable city.

Keywords: bio-based experiential learning; storytelling; sustainability communication; urban farming

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1. Introduction

Studies on sustainability communication revealed that a fresh initiative and creative program of bio-based experiential learning is required [1]. Innovative and interactive campaigns are requested to increase youths' awareness toward a positive social and environmentally friendly behavior change. Sustainability is usually merely an abstract guiding principle that does not convert into specific course offerings. This might suggest the difficulties of operationalizing the notion of sustainability experienced at all levels of education, policy, and society. To stimulate social and emotional engagement with climate change, the participation of young people in climate programs necessitates an innovative and participatory approach [2]. The climate issue has become a moral responsibility of governments, corporations, individuals, and nonprofit organizations [3].

Today, sustainability has progressed from a "buzzword and keyword" to a core notion in searching for a new ecosystem–human balance. Some projects to raise environmental knowledge and concern have been implemented since the United Nations' Sustainable Development Goals (SDGs) were promoted. To achieve the targets, all stakeholders in society must put in significant efforts. However, the number of academics working on raising public awareness about environmental or sustainability communication, particularly for children, is limited. Rural and environmental issues appear to be the main development agenda, despite challenges and new concerns, such as skepticism toward sustainability issues [4]. As a result, implementing the appropriate communication methods is critical for delivering information to the public to navigate their environmental orientation [5].

Communication is becoming increasingly important in fostering a shared understanding of societal values and ensuring long-term sustainability [5]. To build effective

communication, there is a need to choose a channel that allows communication to occur in a straightforward, direct, and precise manner [6]. There are various purposes of communicating, but most forms of communication aim to influence the feelings, thoughts, or even behaviors. The Brundtland Commission defined Sustainable Development in 1987 as "development that meets current needs without compromising future generations' ability to meet their own needs" [7]. Communication in society faces challenges, especially when it comes to the hotly debated topic of sustainability [8].

The pandemic of COVID-19 poses significant difficulties to the world and society. Numerous businesses have aided communities and local governments in handling the pandemic. Communication enables stakeholders to comprehend CSR objectives and fosters trust among the company's core constituents [9,10]. Communicating CSR programs is not just about the output of an activity; it is also about being involved with the "Active Participatory Concept", which is actively participating in the pre- and post-program planning stages.

The argument about the long-term viability of sustainable development and the fulfillment of the 17 SDGs has pervaded the area of media and communication studies as one of the most pressing issues. This study contributed to the achievement of multiple Sustainable Development Goals, including SDG2 (zero hunger), SDG4 (quality education), and SDG11 (sustainable cities and communities). Indeed, while existing planning instruments have the ability to speed up SDG implementation, it remains unclear how historical experiences may be effectively integrated into and strengthen a sustainable local agenda for SDG implementation. This research enables community participation, which is becoming increasingly critical for development and is one of the most critical communication goals. Facilitating community engagement, which is becoming more vital in supporting development, is one of the most significant purposes of communication [11]. Sustainability engagement techniques require effective internal and external communication, playing a critical role in informing all stakeholders. Sustainability communication is considered an emerging field, encompassing various studies, approaches, and practices.

Hence, it is important to analyze public discourse and identify the dominant narratives around the public [3]. Individuals can be informed and educated, social participation can be achieved, and action can be taken with the help of sustainable communication. Communication must be assessed in terms of efficacy, which necessitates the identification of a specific aim [5]. This considers whether the receivers have been contacted, if they have understood the message and whether their attitudes and actions have changed.

Communication for sustainable development can be divided into two pillars: participation and empowerment. Whether in the social, rural, or environmental dimensions, any intervention must be based on a participatory model to be sustainable. Therefore, future concerns are expected to be linked to current needs through communication [12]. Against this background, existing studies examine how sustainability communication and its essence contribute to children's knowledge. This study focuses on teaching systems, processes, and management at the primary level in response to sustainability issues and the state of the school while taking into account its mandate to provide access to quality education. Moreover, based on the proposed findings, this study presents a research agenda for further exploration in the field.

Against the background of the need for improving sustainability in the city of Bandung and the need for effective communication regarding sustainability issues, several researchers and academicians have launched the "Teras Hijau Project" (THP), a community service movement to aid the resolution of ongoing sustainability-related problems in the city. The term "Teras Hijau" comes from the Indonesian language and means "green terrace" in English. THP nurtures the idea of starting a small project for sustainability from home, with the first step of "greening" the house's terrace with vegetables, flowers, and herbs. Overall, THP emphasizes major urban issues in Indonesia to achieve sustainable practices.

Poverty is one aspect that THP attempts to address. The poverty rate in Indonesian cities is not equal to that in the country's rural areas [13]. Rapid decreases in urban poverty

did not match gains in rural poverty reduction between 2004 and 2017. Poverty has a wide range of negative consequences for the city's long-term existence. With their concentrated manufacturing and service industries, people in cities are extremely reliant on the external food supply. They tend to have a rudimentary understanding of food-related concerns. This is related to food security. Generally, despite having better access to technology, urban residents' independence in terms of food availability impacts their food security. They are unable to fulfill their basic needs due to a lack of independence. According to the Bandung City Food and Agriculture Service data in 2020, the city's food supply relies on other regions for 96 percent of its needs. Hence, the people of Bandung are vulnerable to rising food prices. Cities have limited public space due to rapid population growth and urban development.

Furthermore, one of the most difficult challenges facing a sustainable city is waste management due to high-consumption communities. In Indonesia, urban waste management is still facing numerous challenges, particularly in terms of landfill availability. Only 60–70% of wastes can be transported to sanitary landfills and be disposed of [14]. Consumption creates waste, particularly food waste, over-packaging, and e-wastes [15]. Owing to the lack of natural resources, people now begin to feel compelled to think deeply about how to protect them. The zero-waste management system is one of the holistic approaches. Waste management, including waste removal, recycling, reduction, and the reuse of used goods, is included in the zero-waste concept [16].

The city of Bandung, in particular, appears to be growing in population and encountering challenges with domestic waste management. Bandung residents generate 1500 tons of waste per day, according to the Bandung City Environment and Sanitation Service [17]. Although this amount has declined, it remains high as applied to the government's budget for municipal waste management. Cities, starting with homes, must adopt a new approach to waste reduction since households mostly produce food waste. Household food waste adds significantly to environmental and social problems. If global environmental protection is to be accomplished, food waste and overconsumption in the home must be eliminated. The previously mentioned initiatives are highly needed since cities face major challenges in sustainable living spaces, especially for low-income families. Thus, new forms of synergy among various efforts to achieve sustainability are needed [18,19].

Against these backgrounds, THP looked into the European Union's Bio-Economic Initiative, which uses "Circular Economy" as a basis for regional development, as a source of inspiration. A circular economy is an alternative to a traditional linear economy. Resources are used for as long as possible, capturing the maximum use value, and products and materials are restored and regenerated at the end of each service life [20,21].

Overall, THP is expected to emphasize support for food security, food waste management, and local economic empowerment. Given that children in both developed and developing cities worldwide are currently living in dense, unsafe, and polluted neighborhoods, THP also creates programs that use their food garden facilities as a circular economy learning model for children to learn about sustainability. Such facilities are called the "Bio-Based Experiential Learning Facilities", where all forms of implementation occur. The garden is open to children who want to learn biology, understand nature, and learn about the environment.

This paper focuses on one of the projects of THP (i.e., "Bio-based Experiential Learning" program), attempting to measure sustainability communication, targeted at elementary school children and their parents. The research undertaken used a storytelling approach, where researchers try to analyze and construct humans who do not experience life materially [12]. The audience becomes an active participant in storytelling by creating new meanings on top of the author's structure. Instead of receiving messages unilaterally, audiences should participate in messages through interactive storytelling when telling pro-environment stories. Environmental awareness is said to have the potential to be raised effectively through storytelling [22]. The storytelling approach embedded in the bio-based experiential learning program introduces youths to the importance of urban' produce and

agricultural products available in the city and close to where they live. This paper will use the terms "students" and "children" inter-changeably.

2. Literature Review

2.1. Circular Economy Education

The phrase "circular economy" (CE) was coined a few years ago to describe a system that is built on people observing and learning from nature, also known as "biomimicry". Outside of scientific circles, the term was coined to characterize "nature-inspired innovation", which is described as "a method of the invention that seeks long-term solutions to human problems by replicating nature's time-tested patterns and techniques." [23]. The word is derived from the four stages of a typical product life cycle, starting from raw material extraction and processing to manufacture, consumption, and disposal [24].

It is critical to instill the importance of harmonizing our lives with the environment through sustainability education to comprehend these cycles. We recognize that children's comprehension must be taught and practiced early. As a result, we believe that adding circular economy ideas into primary school will help raise awareness about the necessity of engaging in sustainability-related activities from an early age. One of the prominent research projects mentioned the student/scientist partnership (SSP) paradigm [25], in which students are active participants in a scientific research collaboration combining students, teachers, and researchers, has been used in several studies to try to execute a sustainability education program. We do believe that this approach is also suitable to be adopted into our project and even for higher education projects [26].

The circular economy is an alternative consumption and production paradigm to the linear economy, which has dominated society for decades and is unsustainable. The ability to comprehend and apply the circular economy concepts must also be included in the curriculum to be ingrained in design practice [27]. Although not all students will embrace the design for sustainable development, teaching them about the circular economy may indirectly enable them to deal with sustainability issues. Individuals who have a systemic vision, which may be implanted in them at an early age, have a real opportunity of making short-term gains by applying actual principles. As students build a conscious culture, substantial changes may result in schools and their surroundings in the medium and long term. It is critical to present real-world examples that may be used in school settings so that children can learn how they can contribute to sustainability from an early age. Therefore, the solutions must be within the reach of immediate possibilities to promote behavior changes in the near future. This necessitates novel teaching techniques to prepare students for their future roles in their communities.

2.2. Bio-Based Learning

Real efforts are required to prevent future environmental issues, one of which is to foster a positive attitude in children by raising their awareness. Past literature emphasizes the urgent provision of educational opportunities for young people to imaginatively explore their responses to climate change and climate futures, requiring interdisciplinary and collaborative work that positions young people as active participants [2]. This mindset should be instilled in various creative ways since it is not always possible to achieve this through formal education in schools. Various factors, such as family and community support, influence the children's positive attitude. Therefore, bio-based learning aims to provide environmentally conscious learning. Environmental education is based on four indicators: (1) learning to know and understand the environment in all aspects; (2) learning to do (i.e., instilling environmental preservation attitudes, abilities, and skills); (3) learning to live together (i.e., instilling a way of life on Earth that must be preserved for future generations); and (4) learning to be (i.e., instilling a deep belief that humans are part of nature) [28–30]. These ideas serve as a framework for developing the program.

2.3. Education of Sustainability for the Youth

Environmental recognition is one component of the learning materials in early childhood education [31]. The introduction of the environment is intended so that children know, understand, and adapt to the environment around the house and outside the house. With the ever-worrying state of the environment, there must be interventions to raise students' awareness about environmental preservation [32]. Young people have a significant stake in the current and future state of the planet. They will be future leaders to fight against climate change. As a result, youth must grasp the concept of sustainability at a relatively young age. Aligning with these needs, UNESCO addresses some issues to help people develop knowledge, skills, values, and behaviors to begin our society's transformation by reorienting education and assisting people in developing knowledge, skills, values, and behaviors [33].

The principle of sustainable development clearly states that achieving environmental, social, and economic goals simultaneously must meet the needs of the current generation without jeopardizing future generations [34]. Children are interested in creating a sustainable environment that will support longevity and fulfilling life for themselves and future generations [35]. Currently, children live in a constantly changing society, with both challenges and opportunities. Daily life, integrated curriculum approaches, thematic-oriented teaching, authentic topics, and relational and contextual learning are frequently used in early childhood education for sustainability [36]. Through active listening, observing, and analyzing approaches, we can learn more about how children comprehend the material [37]. Children will absorb information from adults while acting as citizens who interpret, reproduce, and create their own culture [38]. Children are seen as the main actors in this approach, where they are expected to contribute to long-term interactions with their environment.

Researchers must find more effective ways to craft and deliver a sustainable message for the pro-environmental mindset to foster consumers' environmental orientation. Previous research has pointed to the need for educational reform to ensure long-term success in this regard. Projects and interactive approaches are encouraged as suitable learning models to increase students' engagement on sustainability issues. The youth's critical thinking will develop when the project's approach is linked to local issues [39]. Early childhood has the potential to be imbued with significant knowledge of the Earth and essential ideas about environmental issues [40]. This study will introduce young people to the importance of produce products and urban agriculture through bio-based learning storytelling. Artists frequently use various forms of work to influence audiences on socio-environmental themes by lowering emotional barriers through storytelling. They have employed persuasion stories with pro-environmental messages [41].

According to previous research, one might describe transformative learning as the process by which we shift the accepted frame of reference and develop beliefs that will lead to more right or motivated action [42,43]. The establishment of a common understanding of the need to combine education for sustainability, traditional knowledge, and transformative learning can be conveyed in the form of storytelling learning. Previous literature has emphasized that storytelling was employed by indigenous peoples to change traditional knowledge and as a meaning-making activity [44,45]. The use of short stories can be told to youngsters to establish an initial awareness of measurement systems and is a means to make information clear and easily accessible. Science facts are made easier to recall by getting individuals to listen to and remember them.

3. Methodology

The research method embedded in the program implemented in this study is Participatory action research (PAR), signifying a dynamic educative method, an approach of social investigation, to address an issue [46]. PAR was chosen because it seeks to develop practical knowledge into a basic guide for youth and is useful in creating a collaborative climate by planning actions with local stakeholders. This qualitative methodology particu-

larly emphasizes the researchers' roles and the participants [47]. As stated in the previous section, the goal of this study is to develop and empower young people to understand sustainability from an early age. In addition, the research also involved storytelling as a narrative paradigm.

In its mandate to remain a collective, self-reflective inquiry to improve a situation, the PAR method offers an alternative to knowledge development [48]. The researchers and the participants collectively try to increase children's awareness to battle against climate change. The participants' case study is presented and evaluated to create consciousness and social change by working together with the target community to address an agreed-upon goal [49]. Participants' opinions were displayed without manipulation from the researchers, and participants were active in making decisions during the research process. Furthermore, the PAR method would grant the researchers privileged access to research subjects in a social setting and provide the researchers with the context of the social setting in which individuals function by recording subjective and objective individual behaviors [50,51]. This study also employs participatory communication techniques. Participation can occur at various levels, including decision making, benefit assessment, evaluation, and implementation. Connecting to the field of communication for sustainable development and social change is always demonstrated through participatory communication [52].

3.1. Data Collection

It is important to define the target community in all PAR studies, especially since the planning cycle involves assessing the target community and working with it to create a strategy for moving forward. In the study, urban youth and their parents were the research targets. Before starting the data collection, the researchers collected some initial data with the participants of interest, analyzed the results, and planned actions. The results of every initial stage were reflected, and the researchers acted on the proposed next steps.

Data collection included participant observations, formal meetings, informal discussions, "catch-ups" with stakeholders, telephone conversations, and documents. Body language, group atmosphere, and other relevant aspects that could not be captured on the audio recording were also noted. Workshop-based participatory action research, in collaboration with a school, involved a Teras Hijau Project team member, West Java learning ambassadors, alumni, undergraduate and master's students, and lecturers who were part of the "Bio-Based Experiential Learning" program. The research was carried out in (4) four stages: (1) participant selection for storytelling workshop: bio-based experiential learning; (2) planting challenge and video storytelling; (3) final workshop: Kid's Green Games; and (4) qualitative and quantitative analyses (see Figure 1).

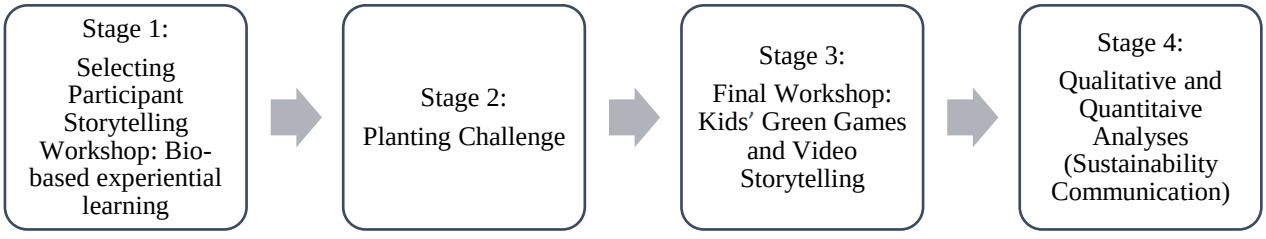

Figure 1. Research design.

Overall, the program introduces the importance of urban farming to 3rd–5th graders in elementary school, followed by a flow of practices, roleplaying, and learning that includes asking related questions leading to the children's mindsets about the importance of farming agriculture in urban areas. To provide the children with interactive concepts, three storytelling concepts have been developed, as follows [53–55].

1. Running Dictation: randomly providing visual running text, with the child rearranging those words. Through this method, it is expected that children can remember the structure, communicate, and rearrange sentences in the correct order.
2. Sorting Sentence: composing the sentences above correctly, potentially ask the children randomly to guess the composition of such sentences, and read them.
3. Clipart Comic Strips: adding animations, which can be taken from their images or pictures to create story plots. This part can test the children to read the plot of the story.

3.1.1. Stage 1—Selection of Participants (15 December 2020–15 January 2021)

The study was conducted in Bandung, Indonesia, aimed at elementary school students. Bandung is a densely populated area and is considered a tourist destination. It can be argued that this region would serve as an example and benefit from urban bio-based learning. The PAR method offers opportunities to promote climate awareness among stakeholders. The sample search was carried out by a team of researchers who contacted the parent association of a private primary school in Bandung, followed by a meeting with the school's vice principal. The student's parents were given a consent form to sign before their children could participate in the program. Finally, 74 children were chosen to represent grades 3 to 5. In the first workshop, 20 students and 20 parents participated in these activities. Meanwhile, 54 students from various grades were present for the second session. Table 1 describes the participants. Data collection occurred from 15 December to 6 February 2021.

Table 1. Grade distribution of student and parent participants.

Remark/Position		Age	Number of Participants	Percentage	Cumulative Percent
Workshop 1	3rd Grade	9–10	6	30.00%	30.00%
	4th Grade	10–11	8	40.00%	70.00%
	5th Grade	11–12	6	30.00%	100.00%
		Total	20		
Workshop 2	1st Grade	7–8	4	7.41%	7.41%
	2nd Grade	8–9	5	9.26%	16.67%
	3rd Grade	9–10	16	29.63%	46.30%
	4th Grade	10–11	18	33.33%	79.63%
	5th Grade	11–12	11	20.37%	100.00%
		Total	54		
Workshop 2	Housewife	25–35	5	25.00%	25.00%
	Teacher	30–45	5	25.00%	50.00%
	Medical Doctor	35–45	2	10.00%	60.00%
	Officer in Private or State Company	35–45	8	40.00%	100.00%
		Total	20		
		Total	94		

3.1.2. Stage 2—First Workshop: "Planting Challenge" (31 January 2021)

Before the workshop began, planting kits (i.e., pots, soil, seedlings, and watercolors to decorate the pots) were sent out. Twenty children and five biology teachers (as observers) attended the first workshop on 31 January 2021. In the beginning, children were taught about the environment through storytelling/narrative stories.

Children learned about natural phenomena, a healthy environment, and the importance of preserving nature using sustainable principles in this workshop. After attending the workshop, the students were initially asked to use their imagination and creativity to decorate the provided planting kits to assess and evaluate their learning experience. They were asked to create 3–5 min videos that include the planting process, environmentally

friendly activities (such as picking up trash or watering plants), and inspirational messages. After 20 videos were submitted, the videos were analyzed by a team of researchers. Selected videos were then posted on social media to make a broader impact.

3.1.3. Stage 3—Final Workshop: "Kid's Green Games" (6 February 2021)

On 6 February 2021, the workshop of Kid's Green Games was held, with 20 children sharing their stories on bio-based learning. The audience of the workshop was a larger number of participants, including children (74), parents (20), and teachers as observers. This activity is important to develop collaborative networks among children, parents, and teachers—the main principle of PAR. This activity drew nearly a hundred people. The workshop began with a presentation by West Java's Learning Ambassador on environmental threats and the importance of loving the environment. The event also provided games for the children to increase audience participation. Meanwhile, researchers carefully examined previously submitted videos to assess the workshop's effect on the children. The team watched the children perform their storytelling, chose the five best videos, and provided input.

3.1.4. Stage 4—Qualitative and Quantitative Analyses (6 February 2021)

To investigate and create a foundation for communicative learning for youth and children, we tried to use a mixed-method approach, incorporating both qualitative and quantitative data analyses. We conducted observations and open-ended interviews to understand and explore the needs and importance of implementing the program and a survey (using a Google form) to reduce observational bias in the analysis. The quantitative method involved administering questionnaires, asking participants whether they agreed or not with a statement. Parents were polled on how satisfied they were with their children's implementation, awareness, involvement, and knowledge.

In addition, children in the audience were given a survey to rate the storytelling performances of their peers. Creativity, ability, plant growth, knowledge, and the workshop's impact were considered. We also used coding based on relevant keywords and unique statements to process the qualitative data. A total of 20 parents responded to the survey.

3.2. Data Analysis

Descriptive statistics were performed to analyze the quantitative data using Microsoft Excel and Google Analytics. The descriptive statistics, including maximum, minimum, and mean values, show the parents' overall perceptions about the Bio-Based Learning Impact, Storytelling Impact, and Communication Impact. Impact value is obtained by averaging the results of the questionnaire and transformed into a scale of 0 to 1.

The qualitative data were gathered based on the semi-structured interviews with parents (transcribed verbatim in Microsoft Word), evaluated, and grouped into several common themes. Manual coding (starting with open coding and ending with selective coding) was conducted. Such a process involved assigning codes to text fragments, categorizing them, and assigning dimensions. Several researchers read the transcript several times to better understand the subject and provide detailed images. The coding was completed using the research questions and literature review as a frame of reference. Patterns and correlations among the codes were constructed, followed by the use of first-level categories to split them down into smaller lists of themes. The survey result was compared to the conclusion of the qualitative data analysis.

4. Results

The purpose of this research was to understand how communication influences urban youth in the context of sustainability-related issues. The observations showed that the children were enthusiastic about receiving sustainability-related information through storytelling during the workshop. Dialogues between children and urban farming THP actors were shown to provide an opportunity for them to learn more about each other.

The kids demonstrated that they could tell a good story. Children were shown to have the ability to receive and relay information to their surroundings persuasively. Facts are meaningless without a contextualized story, such as visual communication for children about THP activities. Such activities attempted to translate a complex and biotechnological process and science in a fun and straightforward manner.

4.1. Quantitative Analysis

The quantitative results (Table 2) consist of five main parts: (1) overall parents' perception, (2) bio-based learning impact, (3) students' communication impact, (4) storytelling impact (i.e., perceptions about students), and (5) storytelling impact (i.e., perceptions about program). In the explanation below, points four and five (i.e., storytelling impacts) will be discussed in the same section.

Table 2. Result of overall parents' and children's perceptions, bio-based learning impact, storytelling impact, and communication impact.

Impact	Feature/Factor	Result
Overall Parents' Perception (*N* = 74)	Implementation by Students	0.87
	Communication Impact on Students	0.84
	Creativity	0.81
	Storytelling	0.75
Bio-Based Learning Impact (*N* = 74)	Environmental Aspect	0.84
	Knowledge	0.71
	Preservation	0.68
	Planting	0.65
Students' Communication Impact (*N* = 74)	Creativity	0.91
	Role of Students	0.87
	Impact	0.84
	Storytelling	0.75
Storytelling Impact (Perceptions about Program) (*N* = 74)	Awareness	0.84
	Knowledge	0.71
	Satisfaction	0.68
	Planting	0.65
Storytelling Impact (Perceptions about Students) (*N* = 74)	Satisfaction	0.90
	Environmental Threat	0.87
	Knowledge	0.87
	Awareness	0.87
	Love of Environment	0.81

4.1.1. Parents' Perception

The 87% score for "Implementation by Students" suggests that most parents agreed that, after the THP program, their children have implemented some forms of environmental practice in their life. Furthermore, 84% of parents agreed that the communication during the program impacted their children. As the program specifically designed behavior that portrayed the important attributes of environmental concern, it can be said that the majority of participants were attuned to the message expressed through the communication taking place during the program. Concerning creativity, 81% of parents agreed that their children have become more creative. Lastly, storytelling received the lowest votes (75%) from parents concerning whether their children also applied the storytelling method in their lives. While still considered high, the percentage may indicate that there may still be an issue associated with practicing storytelling in expressing environmental concerns.

4.1.2. Bio-Based Learning Impact

Regarding whether the program introduced students to learning and understanding every aspect of the environment, 84% of parents provided the necessary evidence. This

implies children's cognitive responses were successfully assigned during the program. Nevertheless, other aspects of the bio-based learning impact on children (for knowledge, preservation, and planting) appear to need more improvements. Only 71% of parents provided evidence that their children have the attitudes, abilities, and skills to preserve the environment (the "learning to do" aspect). This is an important point in that, presumably, the message itself rather emphasized the preservation of the environmental aspect. Therefore, the program could be enhanced to optimize its effectiveness, especially regarding the necessary attitudes, abilities, and skills. Meanwhile, only 68% and 65% of parents provided evidence about the "learning to live together" and the "learning to be" aspect of bio-based learning. Parents provided the evidence via a social messaging group with the researchers.

4.1.3. Students' Communication Impact

Regarding the impact of students' communication, students' creativity received the highest score of 91%. It indicates that students were taught to have a high level of creativity in communication, and they frequently used props. At the same time, students' roles as children in communicating the message was believed (at 87% of agreement) to contribute to the conversation about the environment. Children play an important role in ensuring the environment's long-term viability. Children are a central part of the family, and it is critical that they share their knowledge and experiences with the rest of the family. The statement of children's role was also supported by the agreement of the impact of their communication (at 84%). Storytelling as a method was also considered to contribute highly to communication (with 75% agreement).

4.1.4. Storytelling Impact

Storytelling conveys a message to an audience through the absorption of knowledge by the storyteller. The storytelling impact results are divided into two categories: perceptions about the program and perceptions about the students. About 84% of the audience agreed that the program raised environmental awareness, and 71% agreed that it increased their knowledge. Workshops have a reputation for increasing knowledge, particularly bio-based knowledge. Planting was rated at 65%, and customer satisfaction was at 68% (based on the audience's agreements). Further, based on both the video and live format, students' storytelling satisfied the audience (at 90% of the audience). After listening to the students' storytelling, most audiences also rated the students' awareness, understanding of the environmental threat, and overall knowledge at 87%. Furthermore, 81% of students also stated that their love of the environment had increased through storytelling.

4.2. Qualitative Analysis

The following is the result of the qualitative data analysis based on interviews with parents (P) to evaluate the change in the behavior of children according to four bio-based learning indicators (Tables 3 and 4):

Table 3. Parents' focus group discussion result.

Respondent	Quotation	Code
Q1	*Knowledge is beneficial because children learn many plant planting techniques which I only learned after attending this class. The use of narrative communication is very useful and easy for children to understand.*	Cultivating attitudes and raising awareness.
Q2	*The workshops are easy to understand and useful. Children are also provided with a planting kit to provide hands-on planting experience. In addition, my child has a desire to pick up trash and sort out organic and inorganic waste.*	Knowing the environment, understanding the environment, and instilling attitudes.
Q3	*This event is ideal for raising environmental awareness, learning to plant seeds, preserving the environment, and keeping the environment clean.*	Increased awareness, understanding, and recognition of the environment.

Table 3. *Cont.*

Respondent	Quotation	Code
Q4	*The program was very helpful and provided appropriate explanations and presentations to increase children's awareness of caring for the environment.*	Cultivating attitude and attitude skills.
Q5	*The existence of the COVID-19 pandemic is not an obstacle for Teras Hijau Project to provide direct education to children. The event was held virtually, but children could still experience firsthand how to plant. Thanks to the planting kit provided.*	Participation and attitude improvement.
Q6	*After attending the workshop, my child's awareness for plants is increased. My son is more critical in considering paper towel use because it is related to deforestation. My child is also more efficient in using paper and paper towel.*	Behavior in environmental preservation, critical, and efficient.
Q7	*This workshop combines the art of drawing, the practice of planting seeds, and the art of communicating through storytelling, my son also asked me to grow various vegetables and other plants.*	Live practice, communication, influence, and storytelling.
Q8	*This event is fun and suitable for children because it is held in a fun way. The event also provides games and challenges to increase student participation.*	Participation, fun, and environmental preservation skills.
Q9	*Workshops are very good for children. Hopefully the workshop can be held for the general public so that children are more familiar with bio-based learning and urban farming.*	Cultivation of faith and interest in understanding the environment.
Q10	*I saw changes in children's behavior after attending this series of workshops, such as aspects of responsibility, love for the environment, caring and children invited family, relatives, relatives and friends from one complex to carry out environmental activities.*	Cultivating attitudes, interest in learning, and inviting others.
Q11	*Growing a passion for farming in the younger generation is not easy, unique and fun ways are needed to attract children. This event succeeded in providing a unique way for children to love the environment.*	Interest in learning, loving the environment, and increasing interest.
Q12	*Elementary school participants TK or PAUD (kindergarten) elementary school (need to understand) about THP-related materials with storytelling techniques, including planting plants directly and making videos. Hopefully the workshop can be held again because the children's interest is quite large.*	Hands-on practice, communication, instilling confidence, and increasing interest.
Q13	*My son not only has an impact on himself, he also invites his family, including his brother, to grow crops.*	Action invites others and loves the environment.
Q14	*Through this event, children are given space to be creative. Children can express themselves through the video challenges given.*	Interest in learning and increased interest.
Q15	*Not only increasing love for the environment, this event provides more benefits and knowledge for children and the environment.*	Love the environment and increase interest.
Q16	*Children get knowledge about reforestation and the surrounding environment, as well as get the experience of learning story telling.*	Live practice and communication.
Q17	*This activity is very fun and needs to be continued because it can have a big impact on children.*	Increased interest and fun.
Q18	*This is the first activity that aims to educate children about Bio-based Experiential Learning and provide a safe environment for them to learn to appreciate nature and the environment.*	Respect the environment and interest in learning.
Q19	*Children practice to love the environment, learn to plant seeds, protect the environment, and create a clean environment.*	Interest in learning.
Q20	*The event was very good and hopefully the next one can be felt by the wider community.*	Interest in learning and increased interest.

Table 4. Description and definition from FGD and semi-structured interview.

Theme	Code	Definition
Learning to know and understand the environment	Loving nature, getting to know the environment, and increasing interest in learning.	There is an increase and interest in children to love nature, which is considered a useful approach.
Learning to do	Hands-on practice, attitude cultivation, awareness-raising, interest-raising, and participation in environmental conservation.	The program increases the participation of children to understand and want to contribute positively to the environment.
Learning to live togehter	Invite others, love the environment, and protect the environment.	The program provides concrete steps for children to start loving and caring for the environment, and invites others to do the same.
Learning to be	Participation, communication, and confidence.	There is an increase in environmental protection, encouraging children to participate in simple activities that can have an impact on the environment as a good indicator of change.

4.2.1. Learning to Know and Understand the Environment in All Aspects

"*This is the first activity aimed at educating children about Bio-based Experiential Learning and providing a safe environment for them to learn to appreciate nature and the environment*". (P18)

"*[The Facilitator]'s storytelling workshop for children, which uses the narrative paradigm of communication, is very useful and easy to understand for children*". (P1, P2, P4)

"*This event is ideal for increasing environmental awareness, learning to plant seeds, preserving the environment, and maintaining a clean environment*". (P3, P7)

Based on the above interview excepts, it was revealed that children became fascinated with nature, and the use of an appealing facilitator to get them interested in learning and loving nature was regarded as a useful approach.

4.2.2. Learning to Do (i.e., Instilling Attitudes, Abilities, and Skills in Environmental Preservation)

"*My son has grown in responsibility; after school, he checked the progress of his plants*". (P20)

"*I've noticed that my son has become more concerned; for example, he is more critical in considering how many trees are cut to make a piece of tissue, allowing him to use it more efficiently*". (P6)

"*Because this workshop combines the art of drawing, the practice of growing seed and the art of communicating through storytelling, my son has also asked me to plant a variety of vegetables and other plants*". (P6, P7)

"*I was surprised because, at home, my kids wanted to pick up trash and sort plastic and organic wastes*". (P2, P10)

The interview excerpts above indicate that the younger generation requires concrete examples of how they can participate in environmental preservation, easy-to-understand programs, and role models to understand and be willing to contribute positively to the environment.

4.2.3. Learning to Live Together (i.e., Instilling a Way of Life on Earth That Must Be Preserved for Future Generations)

> "*She has asked her brother and sister to be involved in this activity, such as protecting the environmental and health-related aspects*". (P18)

> "*The changes in eco-friendly behavior of my children can be seen through practices and workshops, as well as challenges of planting*". (P4)

> "*This program is good because it is organized (in) fun and challenging (ways), in terms of growing vegetable crops, I hope it can be improved next year*". (P8, P11)

One approach that needs to be considered is providing an understanding through simple examples for the younger generation to live side by side and take care of one another. As we can see from the interview excerpts above, the activities provided concrete steps for children to begin loving and protecting the environment and inviting others to do so.

4.2.4. Learning to Be (i.e., to Instill a Deep Belief That Human Beings Are Part of Nature)

> "*Participants of an elementary school around THP, kindergarten or early childhood students (need to understand) about THP-related materials with storytelling techniques, including planting plants directly and making videos. Hopefully, the workshop can be held regularly because the interest of children is considerable*". (P5, P8)

> "*The continuity of the workshop program to children is necessary. Socialization can be held for the general public so that children are more familiar with bio-based learning and urban farming*". (P11, P12, P9)

> "*I saw a change in children's behavior after attending this series of workshops, such as aspects of responsibility, love and caring for the environment; children invited their family, siblings, siblings and friends from the same residentials to carry out environmental activities*". (P3)

One of the most important issues is to educate the younger generation about the importance of environmental protection and encourage them to participate in simple activities that can impact the environment.

5. Discussion

Research on the role of communication in sustainability remains scarce today. The main challenge for communication practitioners in solving environmental issues is public communication about sustainability initiatives [56]. Communication is an effort to build and create understanding, acceptance, and cooperation from various parties [57,58]. One of the communication roles in this study is to connect community members to food security and environmental programs. In the development and pursuit of sustainability, communication is essential. Concern for the environment can be instilled in children as close as the family environment [12].

Sustainability communication is an "art" in communicating and influencing the environment in the target's favor. Bio-based experiential learning is expected to raise public awareness about food security by empowering communities and families as the smallest group in the community by providing social benefits, advocacy, and a sense of responsibility [59]. Children's storytelling practices demonstrate the art of communication. The use of the storytelling method can be considered a creative approach and the most effective to change behaviors. It is a recently found method, developed as a meaningful intervention method in social change activities [53,60,61]. Providing audio, prints, still images, and movies with stories and narration can be used in various ways. Communication includes video appearances and movie footage in addition to storytelling. Those ways are meant to serve several functions of communication campaigns that (among others) stimulate emotional response and enhance memorability [62]. Furthermore, direct exposure to children through interactive games and live-action films can increase children's involvement in environmental stewardship.

Children can be taught to serve as Environmental Change Agents, showing more eco-friendly behaviors and sharing firsthand experiences of environmental stewardship and biological activities through video. People involved in environmental issues and having a good ability to process environment-related information from the early years are more likely to elaborate on such knowledge to engage in pro-environmental behaviors [63]. Content in videos that shows pro-environmental solicitation is a practice of public relations communication so that families and society, in general, will better understand how children can enact small-scale initiatives, such as growing vegetables. There are also testimonials from parents that can show the impact and role of third-party endorsers.

Children share videos and experiential learning activities with their peers using social media such as Instagram and YouTube. Some children are nano-influencers because they have a large number of followers. Nano-influencers have social media followers numbering between 1000 and 10,000 people [64]. Influencers play an important role in the community because they provide a higher level of engagement. Influencers can play a role, particularly in the role of environmental change agents. Environmental campaigns are carried out with the help of urban youth ambassadors or influencers to reach a wider audience. So, by shifting the campaign to planting, urban farming can help the environment in the long run. However, the potential for public persuasion by children through a social media platform should be considered with caution. Given the potential negative impacts of social media on children and the youth, such as cyberbullying [65,66], parents should be their guardians of such communication on the social media platform.

6. Conclusions

Overall, this study recommends that family factors, particularly in urban areas, have a unique opportunity to serve as primary agents of development strategies concerning environmental activities. In both developed and developing countries, family farming is the most common form of food production and agriculture, counting for more than 80% of the world's valuable food [67]. Children, as family members, can share what they have learned about bio-based and environmental living, particularly urban farming, in cities. Children's participation sets a good example of education from a young age. Children's sensitivity, emotion, art, fantasy, and imagination can all be activated through storytelling. One way to develop cognitive, affective, social, and conative aspects is to tell stories. In this study, storytelling is one of the most effective ways to instill a sense of care and love in children and help them understand bio-based and environmental practices. It can demonstrate the agricultural strength of Indonesia and the need to develop various innovations, such as in the context of the circular economy's national food security value. Urban farming has the potential to be an economically viable home-based business in the long run.

Bio-Based experiential learning signifies a practice that involves multiple stakeholders. The dialogues embedded in the learning process include children, parents, biology teachers, class guardians, tutors, undergraduate students, master's students, lecturers, alumni, and the community. It is expected that this research can show how effective environmental and food-related community service programs can be organized. Urban farming has become a means of increasing food access in communities. Understanding how plants grow and what types of vegetables, flowers, and fruits are suitable for growing in various climates is critical. This program will be beneficial if it is to be replicated in other schools and receives support from various parties. This research contributes to the development of sustainability education for children and supports the school program of bio-based learning with a new approach. The result also serves to remind governments or policymakers of the role of children in sustainability action through the campaign of urban farming. It has an implication in the long term that can help communities to be more independent in food security and other sustainability initiatives. The authors invite other researchers to take future research directions to evaluate and measure the impact of student campaigns by social media content analysis and focus on the followers'/subscribers' likes of the shared videos of children's posts.

7. Limitation

Several limitations of the study need to be addressed. First, the workshop's setting was virtual, limiting the researchers in capturing non-verbal communication. Nevertheless, face-to-face interactions were also conducted through the role of a facilitator who was experienced in conducting storytelling with children. Second, the study subjects were gathered by having the teacher select one representative (or a maximum of two student representatives) from each class. The researchers did not control the selection process.

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