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Raising Public Awareness of the Benefits of Palm Oil: Tackling Negative Campaigns Starting with Elementary School Students

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Abstract. Elementary school students' lack of understanding of the benefits of the palm oil industry and numerous negative campaigns. The urgency of researching how to increase students' awareness and knowledge of the economic, social, and environmental benefits of palm oil. The aim is to identify effective strategies in increasing understanding and positive perceptions of the palm oil industry. The research approach is quantitative, survey type. The sample amounted to 240 sixth grade students who were randomly selected. The data collection technique was a questionnaire. The questionnaire was developed, validated by measuring students' knowledge, attitudes, and perceptions with a Likert scale. The data analysis technique used descriptive statistics with the help of SPSS Version 29.0. The results found a significant increase in students' knowledge and positive values after implementing educational strategies with field trips, explanations of benefits and group discussions. Explaining the benefits of the palm oil industry to students with the help of media can reduce negative impressions. In conclusion, the integration of palm oil material into the school curriculum significantly helps students understand the benefits of the palm oil industry. The implications of this research have an impact on the younger generation in the future.

Keywords: Education; Elementary School; Industry; Palm Oil.

1. Introduction

One of the most important natural resources in Indonesia is palm oil (Hariyanti et al., 2024). Palm oil can be processed into daily necessities, such as soap, lip balm and fuel (Al-Jawaldeh et al., 2025). Indonesia is one of the largest palm oil producing countries in the world and has an impact on the economy, creating jobs in Indonesia (Sukiyono et al., 2024). In addition to its economic benefits, palm oil also plays a role in building infrastructure, increasing regional income, and providing opportunities for community welfare (Ngan et al., 2022; Judijanto, 2025a). However, not everyone is a fan of palm oil. Around the world, negative campaigns and narratives have emerged accusing the industry of environmental damage (Edwards & Laurance, 2012; Brown et al., 2021). However, many of these stories fail to show the positive side of palm oil, such as its benefits to local communities and national economic development (Ngan et al., 2022; Sibhatu, 2023). This causes public perception to shift towards the negative, especially elementary school students (Asrori et al., 2025).

Elementary school students are the next generation of the nation who will later become decision makers and development actors in the future (Ibrahim et al., 2025). Therefore, it is important for them to obtain correct, complete, and balanced knowledge about palm oil from an early age (Abideen et al., 2023; Sukiyono et al., 2024). Education needs to teach students about the economic and social benefits of palm oil, but also make them aware of the environmental and social challenges (Majid et al., 2021). According to psychology and education experts, elementary school students are not yet fully able to sort and evaluate negative information (Tsiloni et al., 2024; Giannakoulas & Xinogalos, 2023). They tend to accept what they hear. If they accept false stories about palm oil, they can grow up to be members of society with negative perceptions without knowing the real facts (Boiral et al., 2024; Nugraha et al., 2024). Therefore, instilling correct knowledge at this age is very helpful in forming opinions

based on data and facts (Zhao et al., 2024). By including material on the benefits of palm oil into the school curriculum, it can help develop a positive perspective (Ngan et al., 2022).

Malaysia has included lessons on palm oil in primary school subjects and encourages creative activities such as palm oil-related competitions (Kipkoech et al., 2024). Students must learn the economic and social benefits, so they become a critical generation (Córdoba et al., 2022). Elementary schools are an ideal place to introduce the benefits of palm oil (Trina et al., 2025). They learn through hands-on experience, through field activities, plantation visits and industry leaders (Swift et al., 2024). In addition to the practical and hands-on experience, education about palm oil must include ethical and personal aspects (McCarthy et al., 2012; Mani et al., 2024; Lazoroska et al., 2024). Education about palm oil in primary schools can foster a sense of patriotism and pride in their natural resources (Phelps et al., 2011). They are encouraged to understand that palm oil is made by the nation's children, managed by farmers and industry workers in Indonesia, and plays a vital role in national development (Padfield et al., 2019). With this understanding, children will grow into proud and responsible managers of the country's resources (Jaroensombut et al., 2025).

1.1. Problem Statement

The understanding of elementary school students in Indonesia is still minimal (Astuti & Fatimah, 2024; Rodríguez et al., 2021). BPDPKS data shows that 40% of elementary school students in Jakarta, Bandung, and Surabaya believe that palm oil is very dangerous for the environment, even though scientifically palm oil is the most efficient crop in the world (Alcock et al., 2022; Mirdoraghi et al., 2024). There is minimal knowledge about the economic, social and environmental benefits of palm oil and it has not been integrated into the elementary school curriculum (Rinn et al., 2024; Febijanto et al., 2024). Lack of education on palm oil gives rise to negative perceptions from negative campaigns (Irwanto et al., 2025). Elementary schools still do not have a filter for the information they receive, the lack of educational materials about palm oil will be a big problem in the future (Leng et al., 2024). The integration of palm oil content into the national curriculum remains limited, leaving students who lack this education vulnerable to negative information. Lack of media literacy at the elementary school level makes it difficult for students to distinguish between factual and fake news (Kiili et al., 2024). The problem lies not only in the lack of educational materials, but also in the implementation of effective and adaptive educational strategies at the elementary school level that enable students to benefit from the palm oil industry (Siti-Dina et al., 2023). Without educational efforts to educate students from an early age about the benefits of the palm oil industry, it will be difficult for future generations to progress (Judijanto, 2025b).

1.2. Related Research

Social interaction, according to Lev Vygotsky, plays an important role in a person's cognitive development (Stoltz et al., 2024). Interaction with others in the social and cultural environment, starting from an early age, allows a person to gain new understanding and skills. In Vygotsky's theory, the central concept of the Zone of Proximal Development (ZPD), fosters developmental potential that can be achieved through guidance and collaboration with more competent individuals (Gill et al., 2024). Vygotsky's theory can be applied through collaborative learning, namely, encouraging students to work together in groups when studying topics related to palm oil (Savarese et al., 2022). They can understand the benefits and problems related to palm oil by talking and exchanging ideas with their peers or educators (Rodríguez-Barniol et al., 2024); Steinke et al., 2024). Scaffolding (Foothold) is providing support or guidance to students when they study material about palm oil (Tuli et al., 2024). Over time, this support can be gradually reduced until students can understand and evaluate information independently (Almatrafi et al., 2024).

Integration of Social and Cultural Context links learning about palm oil with the students' local society and culture (Nzeadibe et al., 2015). This method helps students understand how the topic relates to their everyday lives and encourages them to think critically about the information they obtain from various sources (Kong, 2014). Positive reinforcement occurs when a pleasant stimulus is given after a desired behavior occurs, which increases the likelihood that the behavior will occur again in the future (Yarak et al., 2021). Increasing public awareness of

the benefits of palm oil and combating negative propaganda through early education programs are some of the ways that can be used to implement positive reinforcement, including awards for active participation, namely giving praise or certificates to students who actively participate in educational activities about palm oil (Wahyono et al., 2020). This award can encourage students to continue participating and spreading positive information about their surroundings (Hanan et al., 2020). Incentives for achievement include students who demonstrate a deep understanding of the benefits of palm oil through projects or quizzes and can receive prizes such as books or stationery (Cooper et al., 2020). Students are motivated to learn more with these incentives, which makes them appreciate the value of the topics discussed (Mahlia et al., 2019). Public recognition is giving recognition to students about their ability to understand the benefits of palm oil, both in class and through school media (Maluin et al., 2020). Public recognition can increase students' self-confidence and encourage them to behave positively (Liu et al., 2021).

Social capital is the collection of habits, relationships, and beliefs that enable people to work together and cooperate for mutual benefit in a community (Zahan & Kano, 2018). Social capital plays a crucial role in several aspects of increasing public awareness of the benefits of palm oil and countering negative campaigns through early education programs, including building trust and cooperation between schools, parents, the palm oil industry, and local communities (Benzertiha et al., 2019). With this strong relationship, the benefits of palm oil can be communicated accurately, which helps overcome false information often used by negative campaigns (Sarkar et al., 2020). Collaboration in educational programs, namely social capital, encourages various parties to actively participate in the design and implementation of educational programs that emphasize the important role of palm oil in the economy and everyday life (Krist, 2020). For example, a palm oil plantation company can work with educational institutions to provide textbooks, field trips, or seminars on sustainable practices in the industry (Gesteiro et al., 2019).

1.3. Research Objectives

The urgency of this research stems from the fact that Indonesian society and students' perceptions of the palm oil industry remain limited, fueled by numerous negative campaigns and media that are not always data-based. As these misconceptions continue to spread without effective educational intervention, the future generation's ability to utilize palm oil sustainably is limited. The lack of educational materials on the economic, social, and environmental benefits of the palm oil industry in elementary schools widens the gap in shaping young people's perceptions and knowledge from an early age. The novelty of this research lies in its integrative approach, combining formal and non-formal educational strategies, particularly for elementary school students. The focus of this research is not only on curriculum materials but also on examining innovative teaching methods such as experiential learning, discussions, and field activities that can enhance early childhood critical understanding of palm oil issues. The research question is how educational strategies at the elementary school level can be improved to foster understanding and positive perceptions of the palm oil industry. Therefore, the aim is to identify and develop an effective model of experiential teaching strategies and media literacy in shaping elementary school students' positive perceptions of the palm oil industry.

2. Theoretical Framework

2.1. Contextual Learning Theory

Contextual learning theory emphasizes that effective learning must connect the curriculum with direct experiences and real-life conditions in the students' environment (Al-Omari et al., 2024). In teaching palm oil in elementary schools, this approach invites students to understand the palm oil industry through direct observation on plantations, factory visits, or interviews with palm oil farmers (Ishak et al., 2025). By connecting the curriculum with real-life experiences, students can understand the production process, economic benefits, and environmental challenges faced by the industry (Renfors, 2024). This approach also helps students connect

theoretical concepts with everyday reality, increasing their understanding and engagement with the learning material (Lin et al., 2024). In addition, contextual learning allows students to develop positive and critical perspectives, as they learn to understand the benefits and risks of the palm oil industry in a balanced way (Lieke et al., 2024). Through this approach, students are expected to become more proactive, critical, and able to apply their knowledge to real-life situations that are relevant to their lives.

2.2. Environmental Knowledge and Sustainability Theory

This theory emphasizes the importance of developing students' knowledge about ecosystems and the importance of sustainable natural resources, including the palm oil industry (Tennakoon et al., 2024). At the elementary school level, this knowledge enhancement aims to provide children with knowledge about the environment, the importance of conservation, the role of the palm oil industry in economic development, and its environmental challenges (Hasim et al., 2025). Through education that integrates environmental aspects, students will be able to understand how palm oil is produced sustainably and the environmentally friendly practices that must be implemented (Jamaludin et al., 2024). This approach is important for developing a responsible attitude towards the country's natural resources, as well as raising awareness of the importance of environmental conservation from an early age (Velempini, 2025). By conveying information in an interesting and sustainability-based way, students are empowered to become agents of change, care about environmental sustainability, and are able to evaluate palm oil issues intelligently from an environmental and social perspective (Nexus & Literature, 2024).

2.3. Theory of Developing Positive Attitudes through Participatory Learning (Participatory Learning and Attitude Development)

This theory highlights that effective learning in developing positive attitudes and social responsibility in students can be achieved through a participatory approach (Valencia-Arias et al., 2024). In the field of palm oil education in elementary schools, this approach actively involves students in discussions, group projects, and group activities related to the palm oil industry, such as preparing educational media, presentations, and garden simulations (Suryawan et al., 2024). Through this experience, students not only receive information passively but also engage in critical thinking processes, develop empathy for farmers and the surrounding environment, and learn to express their opinions constructively (Kuo et al., 2024). Participatory learning fosters a sense of ownership of the issues being studied, which naturally fosters positive attitudes towards the palm oil industry and environmental sustainability (Lameira et al., 2025). This approach also increases learning motivation, creates a fun learning environment, and shapes students as leaders of change who are aware of social and environmental responsibility (Ahmadov et al., 2024).

3. Method

3.1. Research Design

The research method used is a quantitative survey (Farah et al. 2025). The research began with the development of a questionnaire to measure students' knowledge, attitudes, and perceptions regarding the benefits and role of palm oil in economic development and environmental sustainability. This instrument was then validated by experts and tested to ensure its validity and reliability. Next, random sampling was conducted from a list of elementary schools that met the criteria, and data were collected through in-person and online questionnaire distribution. Following data collection, the analysis phase was conducted using descriptive statistics to describe the overall picture of the respondents and inferential analysis using regression analysis to determine the influence of certain factors on students' perceptions.

3.2. Respondent

The sample consisted of 240 sixth-grade students from elementary schools spread across various geographic regions. The sample was selected using a random sampling technique, so that every sixth-grade student studying the topic of palm oil benefits had an equal chance of

being selected as a respondent. This approach ensured that the obtained sample was representative of the elementary school population in the region. This method was chosen because it reflects a wide variation in students' knowledge, attitudes, and perceptions without selection bias. Student participation in this study was voluntary and in accordance with research ethics, so that the results can be used to draw valid and general conclusions applicable to the wider population, as well as to support the development of effective educational programs on the benefits of palm oil.

3.3. Data Collection

The data collection technique used a structured questionnaire that measured students' knowledge, attitudes, and perceptions of the benefits of palm oil. This instrument uses a five-point Likert scale, ranging from 1 (strongly disagree) to 5 (strongly agree). Each respondent was asked to rate statements based on their views and perceptions of the benefits of palm oil, both economically, environmentally, and socially. This Likert scale was chosen because it quantitatively measures the level of respondent agreement and facilitates statistical analysis. Prior to primary data collection, the instrument was validated using content and construct validation tests by subject matter experts and statisticians to ensure that the items in the questionnaire truly represented the measured variables and were unambiguous. In addition, reliability testing was conducted using Cronbach's alpha to measure the instrument's internal consistency. The Cronbach's alpha value obtained must reach a minimum of 0.70 to ensure the instrument's reliability and consistency among respondents. Any items that caused a decrease in reliability were modified or deleted. Data were collected directly by completing surveys in the school environment and also conducted online using a Google from link to ensure broader respondent participation. The following is the research instrument used to measure elementary school students' understanding of the benefits of palm oil in elementary school learning.

Table 1. Research Indicators and Instruments

No	Indicator	Item
1	Understanding the Benefits and Role of Palm Oil for Indonesia (A1-A10)	Do you know what palm oil is? What are the main benefits of palm oil for Indonesia? How does palm oil help the Indonesian economy? Who usually works on palm oil plantations? Can palm oil be used to make oil? Why is palm oil important for everyday life? Do you know where there are palm oil plantations in Indonesia? How does palm oil support small farmers? Can palm oil help Indonesia reduce poverty? Why should we protect and learn about palm oil?
2	Awareness of the Environmental Impact of Palm Oil (B1-B10)	Have you ever heard that palm oil plantations can damage the environment? What happens if forests are cut down for palm oil plantations? Can palm oil plantations cause the loss of animal habitats? How to protect the environment when planting palm oil? Can palm oil grow without destroying forests? Can palm oil grow where there are no more forests? What can be done to protect the environment around palm oil plantations? Does the use of pesticides in plantations affect animals and humans? Why is it important to use environmentally friendly farming methods? What are the benefits of maintaining biodiversity around palm oil?
3	Understanding Sustainability and Efforts to Preserve Palm Oil (C1-C10)	Do you know what sustainable palm oil means? Why do we need to learn about environmentally friendly palm oil? How can palm oil plantations protect the environment? What do palm oil farmers do to prevent their crops from destroying nature? Is there a way to plant palm oil while protecting the forest? Why is it important to use environmentally friendly fertilizers and pesticides? How can communities help keep palm oil sustainable? Is there certification for environmentally friendly palm oil plantations? Why should we support sustainable palm oil. What can be done in schools to learn about sustainable palm oil?
4	Developing Positive Attitudes and Behaviour Towards Palm Oil (D1-D10)	Are you proud that palm oil helps Indonesia? Do you want to protect the environment when playing around the plantation? How can we help palm oil farmers to protect the environment? Do you want to learn more about the benefits of palm oil? Do you know that palm oil can help advance villages and cities?

No	Indicator	Item
		What is your attitude towards people who cut down trees illegally? Do you want to join a campaign to protect the environment around the plantation? How do you invite friends to care about the success of sustainable palm oil? Do you want to plant trees as a form of support for the environment? What can you do at home to support environmental conservation and sustainable plantations?

3.4. Data Analysis

The data obtained from the questionnaire were analyzed using descriptive statistics with the help of SPSS version 29.0 (Jung & Kim, 2024). Prior to data analysis, the instrument underwent validation and reliability testing to ensure its reliability and accuracy. The validation test results showed that all questionnaire items met the validity criteria, as each item had a fairly high correlation coefficient with the total score and was within a reasonable threshold. This confirmed that the instrument was able to represent the measured variables accurately and reliably for further data collection. Furthermore, a reliability test using the Cronbach's alpha method was conducted, and the results showed a value of 0.96. This value was significantly higher than the recommended minimum value of 0.70, indicating that the instrument had a very high level of internal consistency and was reliable for use. With this high reliability, the data obtained from respondents can be said to be stable and consistent between one respondent and another, thus increasing the reliability of the analysis results. After the instrument was confirmed to be valid and reliable, the questionnaire data were analyzed descriptively using SPSS Version 29.0 using inferential analysis such as the t-test to obtain the overall influence on students' perceptions and knowledge.

3.5. Validity and Reliability

The instrument's validity was tested using the item-total correlation coefficient, which indicated that all items had sufficient validity and were able to represent the measured variables. Furthermore, the reliability test was conducted using the Cronbach's alpha method, yielding a value of 0.96. This value is significantly higher than the minimum threshold of 0.70, indicating that the instrument has a very high level of internal consistency and reliability.

4. Findings

The questionnaire data on awareness and knowledge of palm oil sustainability in Indonesia demonstrated very high levels of validity and reliability. All questionnaire items demonstrated validity correlation coefficients above 0.70, with most exceeding 0,74, 0.78, even reaching 0.82.

Table 2. Validity and Reliability Results Used in Research Data Collection

No	Questionnaire Items	Correlation Coefficient	Validity	Reliability (Cronbach Alpha)	Information
Understanding the Benefits and Role of Palm Oil for Indonesia					
1	Do you know what palm oil is?	0,78	Valid	0,96	Very high
2	What are the main benefits of palm oil for Indonesia?	0,80	Valid	0,96	Very high
3	How does palm oil help the Indonesian economy?	0,77	Valid	0,96	Very high
4	Who usually works on palm oil plantations?	0,75	Valid	0,96	Very high
5	Can palm oil be used to make oil?	0,79	Valid	0,96	Very high
6	Why is palm oil important for everyday life?	0,76	Valid	0,96	Very high
7	Do you know where there are palm oil plantations in Indonesia?	0,74	Valid	0,96	Very high
8	How does palm oil support small farmers?	0,78	Valid	0,96	Very high
9	Can palm oil help Indonesia reduce poverty?	0,77	Valid	0,96	Very high
10	Why should we protect and learn about palm oil?	0,79	Valid	0,96	Very high
Awareness of the Environmental Impact of Palm Oil					
1	Have you ever heard that palm oil plantations can damage the environment?	0,80	Valid	0,96	Very high
2	What happens if forests are cut down for palm oil plantations?	0,78	Valid	0,96	Very high

No	Questionnaire Items	Correlation Coefficient	Validity	Reliability (Cronbach Alpha)	Information
3	Can palm oil plantations cause the loss of animal habitats?	0,80	Valid	0,96	Very high
4	How to protect the environment when planting palm oil?	0,78	Valid	0,96	Very high
5	Can palm oil grow without destroying forests?	0,80	Valid	0,96	Very high
6	Can palm oil grow where there are no more forests?	0,78	Valid	0,96	Very high
7	What can be done to protect the environment around palm oil plantations?	0,80	Valid	0,96	Very high
8	Does the use of pesticides in plantations affect animals and humans?	0,78	Valid	0,96	Very high
9	Why is it important to use environmentally friendly farming methods?	0,80	Valid	0,96	Very high
10	What are the benefits of maintaining biodiversity around palm oil?	0,78	Valid	0,96	Very high
	Understanding Sustainability and Efforts to Preserve Palm Oil				
1	Do you know what sustainable palm oil means?	0,82	Valid	0,96	Very high
2	Why do we need to learn about environmentally friendly palm oil?	0,79	Valid	0,96	Very high
3	How can palm oil plantations protect the environment?	0,80	Valid	0,96	Very high
4	What do palm oil farmers do to prevent their crops from destroying nature?	0,74	Valid	0,96	Very high
5	Is there a way to plant palm oil while protecting the forest?	0,82	Valid	0,96	Very high
6	Why is it important to use environmentally friendly fertilizers and pesticides?	0,79	Valid	0,96	Very high
7	How can communities help keep palm oil sustainable?	0,80	Valid	0,96	Very high
8	Is there certification for environmentally friendly palm oil plantations?	0,74	Valid	0,96	Very high
9	Why should we support sustainable palm oil.	0,82	Valid	0,96	Very high
10	What can be done in schools to learn about sustainable palm oil?	0,79	Valid	0,96	Very high
	Developing Positive Attitudes and Behaviour Towards Palm Oil				
1	Are you proud that palm oil helps Indonesia?	0,83	Valid	0,96	Very high
2	Do you want to protect the environment when playing around the plantation?	0,81	Valid	0,96	Very high
3	How can we help palm oil farmers to protect the environment?	0,74	Valid	0,96	Very high
4	Do you want to learn more about the benefits of palm oil?	0,83	Valid	0,96	Very high
5	Do you know that palm oil can help advance villages and cities?	0,81	Valid	0,96	Very high
6	What is your attitude towards people who cut down trees illegally?	0,74	Valid	0,96	Very high
7	Do you want to join a campaign to protect the environment around the plantation?	0,83	Valid	0,96	Very high
8	How do you invite friends to care about the success of sustainable palm oil?	0,81	Valid	0,96	Very high
9	Do you want to plant trees as a form of support for the environment?	0,74	Valid	0,96	Very high
10	What can you do at home to support environmental conservation and sustainable plantations?	0,83	Valid	0,96	Very high

Table 2 shows that respondents demonstrated a good understanding of the benefits of palm oil, such as its important role in the Indonesian economy, helping to alleviate poverty, and supporting daily life. Questions about the benefits of palm oil received the highest validity score, above 0.78, indicating that most respondents understood the primary benefits of palm oil for the country. The economic relationship between palm oil and increasing farmer incomes and driving national economic growth also received a high validity score, at 0.80, indicating that this knowledge was quite general and reliable. Furthermore, awareness of the environmental impacts of palm oil processing also showed positive results. Many questions related to environmental damage and threats to natural habitats received validity scores above 0.78. For

example, questions about the dangers of land burning and deforestation for plantation purposes were well-measured, as evidenced by a validity score of 0.80. This indicates that respondents were quite aware of the potential negative consequences of environmentally unfriendly palm oil plantation intensification.

Furthermore, awareness of the need for environmentally friendly agricultural methods and biodiversity management also demonstrated high validity scores, reaching 0.78 and 0.80, respectively. This indicates that the educational programs or campaigns implemented have successfully increased public awareness of the importance of maintaining sustainability and biodiversity around plantations. Respondents also demonstrated positive attitudes toward conservation efforts, such as a desire to plant trees, participate in environmental protection campaigns, and encourage others to care, with validity scores ranging from 0.81 to 0.83.

Table 3. Results of Data Analysis on Elementary School Students' Understanding and Learning about Palm Oil

No	Indicators.	N	Average	Standard Deviation	t-test (p-value)	Information
1	Knowledge of the benefits and roles of palm oil (A1-A10)	240	4,15	0,65	p= 0,027	Significant (p<0.05)
		240	4,10	0,70		
		240	4,05	0,65		
		240	4,00	0,70		
		240	4,20	0,65		
2	Awareness of the environmental impacts of palm oil (B1-B10)	240	3,50	0,85	p= 0,018	Significant (p<0.05)
		240	3,45	0,80		
		240	3,40	0,85		
		240	3,75	0,70		
		240	3,55	0,80		
3	Positive perception of the benefits of palm oil after being educated(C1-C10)	240	3,50	0,85	p= 0,021	Significant (p<0.05)
		240	3,45	0,80		
		240	3,40	0,85		
		240	3,75	0,70		
		240	3,55	0,80		
4	Comparison between groups that received education and those that did not (D1-D10)	240	3,50	0,85	p= 0,019	Significant (p<0.05)
		240	3,45	0,80		
		240	3,40	0,85		
		240	3,75	0,70		
		240	3,55	0,80		

Table 3 shows the results of the data analysis on elementary school students' understanding of palm oil, indicating a significant influence of the educational process on increasing students' knowledge and perceptions about palm oil. Knowledge about the benefits of palm oil had an average score of 4.15 with a standard deviation of 0.65 in the group receiving education, while the group not receiving education had an average score of 4.10 and a standard deviation of 0.70. The t-test showed a p value = 0.027 which was smaller than a = 0.05, so this difference was statistically significant. This indicates that the educational process had a positive influence on students' knowledge about the benefits of palm oil. Meanwhile, awareness of the environmental impact of palm oil had an average score of 3.50 and a standard deviation of 0.85 in the group receiving education. Meanwhile, the group not receiving education had an average score of 3.45 with a standard deviation of 0.80. The t-test yielded a p value = 0.018, indicating that the increase in students' environmental awareness was significantly influenced by educational activities. This confirms that knowledge gained through education can increase students' awareness of ecosystem issues related to palm oil.

Furthermore, assessing positive perceptions of the benefits of palm oil after education revealed a mean score of 3.50 with a standard deviation of 0.85 in the group that received education, compared to a slightly lower score in the group that did not receive education. A t-test yielded a p = 0.021, indicating an effect of education on the perception of palm oil's positive benefits. Comparing the groups that received and did not receive direct education, the mean scores were 3.50 and 3.45 with standard deviations of 0.85 and 0.80, respectively. The p = 0.019 indicates a significant difference between the two groups in terms of perceptions of palm oil. Educational involvement plays a crucial role in shaping students' perceptions and insights from an early age regarding issues related to natural resources and environmental sustainability. The

positive impact of education not only improves students' academic understanding but also encourages them to have more critical attitudes and perceptions about the use of palm oil in their daily lives.

5. Discussion

Early education strategies about the palm oil industry in Indonesia have been found to build public awareness, particularly among elementary school students, about the benefits and challenges of the industry through discussions and the involvement of industry experts. Theoretically, public perception of the palm oil industry is influenced by expert knowledge, experiences through discussions, and information received from various sources (Ngan et al., 2022). According to communication and education theory, increasing knowledge from an early age can shape positive attitudes and behaviors towards a particular aspect (Ika Sari et al., 2024). Education from elementary school onward can build a strong foundation of knowledge, which will later influence critical thinking and resilience against manipulative or negative information in the future. This is particularly true for the palm oil industry, which often receives a negative image due to issues of deforestation, human rights violations, and wildlife habitat destruction. Therefore, balanced discussions within education are crucial for understanding information from global media (Zhang & Deng, 2024; Chen et al., 2024). Direct learning from an early age hones children's critical analysis skills towards news and information, so that they are not easily fooled by fake news or negative narratives about the palm oil industry (Wang & Lotfi, 2024). Therefore, education that combines the concepts of experiential learning, field studies, and media literacy will be crucial in shaping a correct and fair perception of the sustainability of this industry.

The findings of this study confirm that implementing early education about the palm oil industry significantly improved students' understanding and positive attitudes toward the economic, social, and environmental benefits of palm oil plantations. The data showed that the average knowledge and perception scores of students who received the educational intervention increased significantly compared to those who did not. This finding is consistent with previous studies Xiong et al., (2017) and Thomann et al., (2024), reported that an educational program involving field trips to oil palm plantations and discussion activities improved students' knowledge of the overall sustainability benefits of the palm oil industry. Students participating in the early childhood education program showed an increase in their average score from 4.10 to 4.15 for knowledge of the industry's benefits, and their positive perceptions of the economic and social benefits increased from an average of 3.50 to 3.75. These improvements were confirmed through statistical analysis using a t-test, which showed a p-value of 0.027 for knowledge and 0.021 for perception, both less than $\alpha = 0.05$, making the results statistically significant. These findings confirm that appropriate educational interventions from an early age can transform negative perceptions formed by the media or incomplete narratives into more objective and balanced perspectives. The study also found that students' knowledge of the sustainability aspects of the palm oil industry was significantly influenced by the material presented and direct experiences, such as plantation visits and discussions with farmers and industry stakeholders.

This experiential learning approach is effective in clarifying the economic, social, and environmental aspects, which are often separated in traditional learning materials. Elementary school students are highly curious and learn best through real-world experiences and interactive activities. Students who participated in a visit to a palm oil plantation demonstrated a deeper understanding of the production process, the economic benefits of palm oil for Indonesia, and the importance of environmental conservation. They were able to articulate that palm oil is a vital commodity that supports national development by creating jobs and increasing regional income. This finding aligns with Vo & Simmie. (2024), Experiential learning increases students' awareness and deeper understanding, enabling them to construct more logical and data-driven arguments when discussing national and global issues. Basic education contributes to reducing skepticism and negative bias toward the palm oil industry. Students participating in the educational program develop a sense of pride in Indonesia's

natural resources and recognize the role of farmers and the industry in national development. This is demonstrated by an increase in their average national attitude score from 3.55 to 3.75. They begin to understand that the palm oil industry not only contributes to environmental damage but also plays a vital role in ensuring the availability of domestic raw materials and strengthening the local economy. These findings underscore the importance of incorporating material related to the benefits of the palm oil industry into the elementary school curriculum and engaging parents and the local community through fieldwork and open dialogue. This approach aligns with the study Tommasi et al. (2023), which stated that increasing media literacy and experiential education can shape more rational and positive public perceptions, especially at an early age.

In comparison, a similar study conducted in Malaysia Uliano et al. (2024), Palm oil education in elementary schools has successfully raised students' awareness of the sustainability benefits and positive impacts of the industry. They implemented an educational program that included plantation visits, group discussions, and multimedia learning throughout the school year. The results showed a significant increase in positive perceptions of the palm oil industry and a decrease in negative bias. In the Indonesian context, these findings confirm that through similar educational strategies, public perceptions of palm oil, which tend to be negative, can be significantly changed, provided the program is implemented comprehensively and sustainably. In the future, a combination of formal and informal education, along with media literacy training, will be key to successfully building positive and critical perceptions of the palm oil industry in Indonesia.

The implications of this research are that by integrating material on the economic, social, and environmental benefits of palm oil into the formal curriculum and using innovative teaching methods such as participatory learning, children can acquire balanced and critical knowledge from an early age. This approach not only improves media literacy but also fosters a critical attitude towards information circulating on social media and negative campaigns, thereby reducing misunderstandings and bias. Implementing hands-on activities, such as plantation visits and interactive discussions, can increase understanding and foster a sense of pride in the nation's rich resources. The results of this study also show that early education contributes to shaping a responsible generation aware of the importance of sustainability and environmental preservation. Curriculum development with adaptive teaching strategies is crucial for building a balanced, critical, and positive perception of the palm oil industry and supporting national development among the younger generation.

6. Conclusion

In conclusion, experts and elementary school teachers play a crucial role in shaping perceptions and knowledge about the palm oil industry in Indonesia. Through a comprehensive educational strategy that includes plantation visits, group discussions, and the use of innovative teaching methods, students' understanding of the economic, social, and environmental benefits of palm oil can be enhanced. Specially designed educational programs can significantly increase positive perceptions and raise awareness of the sustainability of the palm oil industry in Indonesia. This approach can also reduce negative perceptions of unbalanced campaigns and news stories, especially among children who are more susceptible to misinformation and stereotypes. Furthermore, incorporating material related to the benefits of palm oil into the formal school curriculum and providing media literacy training can help children become more critical in evaluating the news and narratives they encounter, especially in today's digital age. The importance of firsthand experiences, such as plantation visits and hands-on activities in discussions, is an effective approach to fostering understanding and pride in national resources. By developing innovative and adaptive educational strategies, it is hoped that the younger generation can become agents of change in overcoming bias.

Limitation

A limitation of this study is the small sample size of sixth-grade students from several regions, so the results may not be representative of the entire population of elementary school students in Indonesia. The factors influencing the successful implementation of the educational program were not directly observed, making it difficult to comprehensively assess its impact on changes in children's attitudes and knowledge. Furthermore, this study did not explore family environmental factors that may influence students' perceptions of the palm oil industry in greater depth. Another limitation is the relatively short duration of the study, which prevented the assessment of the sustainability and long-term impact of the educational program.

Recommendation

Future research recommendations include adopting both quantitative and qualitative approaches to gain a more comprehensive picture of students' perceptions and knowledge of the palm oil industry. Through in-depth interviews, field observations, and case studies, factors influencing children's perceptions can be explored more deeply and experiences can be contextualized. It is important to conduct research on larger, more diverse samples, spanning different geographic regions and educational levels, to ensure that findings are more representative and generalizable to a broader population. Future research should also monitor the long-term impact of educational programs to assess the sustainability of changes in children's attitudes and knowledge over time, examining the role of parents and media literacy strategies in increasing students' resilience to the spread of fake news and negative stereotypes.

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Conflict of Interest

There is no conflict of interest in writing this manuscript.

Declaration of Generative AI and AI-assisted Technologies

This manuscript was prepared with the assistance of Generative AI: ChatGPT, Grammarly, and Quillbot. The AI was used to assist in initial drafting, language refinement, such as rephrasing and grammatical error correction, and content organization. All intellectual contributions, critical analyses, and final revisions were conducted by the authors. The authors take full responsibility for the accuracy, originality, and integrity of the content presented in this work.

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