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Empowering environmental awareness in Kindergarten: A community development initiative on plastic waste management

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Abstract
This study documents a community development initiative at Ar-Rasyid Kindergarten to educate young students about plastic waste management through practical activities. The method involved conducting training sessions or workshops and providing guidance in making pencils from plastic waste. Guided by a community service team, kindergarten students engaged in hands-on projects to repurpose plastic bottles into pencil holders. Pre-tests assessed initial understanding, revealing varying levels of awareness among students. Following educational sessions and post-tests, significant improvements were observed in students' comprehension of recycling and environmental stewardship. The initiative fostered creativity and practical skills and instilled a sense of environmental responsibility in students. This underscores the importance of early education in shaping sustainable behaviors and promoting a cleaner, healthier environment. Such initiatives highlight the potential of educational interventions to empower future generations in combating plastic pollution and fostering sustainable practices.

Keywords: Community service, Plastic waste management, Environmental education, Recycling, Sustainability.

Abstrak
Studi ini mendokumentasikan inisiatif pengembangan masyarakat di Taman Kanak-Kanak Ar-Rasyid untuk mengedukasi anak usia dini tentang pengelolaan sampah plastik melalui kegiatan praktis. Metode kegiatan meliputi pelatihan atau workshop dan pendampingan dalam praktik membuat pensil dari sampah plastik. Dipandu oleh tim pengabdian masyarakat, siswa-siswa TK terlibat dalam proyek-proyek praktis untuk mengubah botol plastik menjadi tempat pensil. Pre-test digunakan untuk menilai pemahaman awal, yang mengungkapkan tingkat kesadaran yang bervariasi di antara siswa-siswa. Setelah sesi-sesi edukasi dan post-test, terlihat peningkatan signifikan dalam pemahaman siswa tentang daur ulang dan pengelolaan lingkungan. Inisiatif ini mendorong kreativitas dan keterampilan praktis serta menanamkan rasa tanggung jawab lingkungan pada siswa. Hal ini menegaskan pentingnya pendidikan dini dalam membentuk perilaku berkelanjutan dan mempromosikan lingkungan yang lebih bersih dan sehat. Inisiatif semacam ini menyoroti potensi intervensi pendidikan untuk memberdayakan generasi masa depan dalam memerangi polusi plastik dan mendorong praktik-praktik berkelanjutan.

Kata kunci: Pengabdian masyarakat, Pengelolaan sampah plastik, Pendidikan lingkungan, Daur ulang, Keberlanjutan.

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1. Introduction

Educating children as early as ages 5 to 6 about the 3R principles (Reduce, Reuse, Recycle) is essential for promoting responsible consumption and production, in line with Sustainable Development Goal (SDG) 12. Integrating these principles into early education can significantly aid in reducing environmental pollution and encouraging responsible waste management. Studies show that incorporating SDGs into the K-12 curriculum improves students' understanding of resource sustainability and their role in ecological protection (Koçulu & Topçu, 2024). Workshops and interactive activities have effectively taught children about sustainable behaviors, such as proper disposal of food packaging, which can be extended to managing plastic waste (Norton et al., 2023). Environmental education, which is mainly focused on preventing plastic pollution, is a practical and cost-effective method to instill sustainable consumption behaviors from a young age (Liu et al., 2023). Behavioral interventions, including indirect incentives, normative messaging, and visualizing the impacts of plastic use, have shown promise in reducing plastic bag usage and can be adapted to encourage younger audiences to follow the 3R principles (Luo & Jiaying, 2023).

Sustainable development education, particularly the 3R principles, is essential for fostering responsible consumption and production, aligning with Sustainable Development Goal (SDG) 12, and should be introduced as early as kindergarten. Integrating these principles into early education can nurture a generation that is environmentally conscious and proactive in sustainability efforts. Research highlights the importance of embedding sustainability into curricula to enhance students' understanding and engagement with SDGs. For example, a study on integrating SDGs in architectural design courses showed that students quickly grasped and promoted sustainable practices when these concepts were part of their learning environment (Liao & Tang, 2023). Similarly, game-based learning, such as the SDGs Board Game, has proven effective in making sustainability concepts accessible and engaging, enhancing learners' knowledge and reflecting on sustainable development goals (F. H. Chen & Ho, 2022).

The Whole Institution Approaches (WIAs) to sustainability stress the need for continuous and participative organizational learning processes that link formal and informal curricula, fostering a culture of sustainability within educational institutions (Holst, 2023). This approach is supported by findings from a study on Finnish and Italian education systems, which highlight the role of assessment and qualitative organization in achieving the objectives set by Agenda 2030, including sustainability (Messina, 2023). Moreover, the EnAct-SDGs project at the AGH University of Science and Technology in Krakow revealed that students are increasingly aware of the importance of sustainable development, indicating a demand for educational content that integrates economic, social, and environmental issues (Zwolińska et al., 2022).

Promoting pro-environmental behavior through education is also critical. Initiatives that foster action competence enable students to contribute to sustainable development through self-directed, project-based learning (Kalla et al., 2022). In rural

Japanese universities, SDG education has deepened students' understanding of community sustainability, encouraging them to consider sustainable practices in their future work (Ohta et al., 2022). Additionally, a survey of Chinese students' knowledge, attitudes, and behaviors regarding sustainable development highlighted the importance of early education in fostering sustainability literacy, particularly in the environmental dimension (C. Chen et al., 2022).

Finally, the role of companies in promoting SDG 12 through sustainability reporting and responsible consumption practices is a beacon of hope for the broader societal impact of sustainability education (Vallet-Bellmunt et al., 2023). By introducing the 3R principles in kindergarten, educators can lay a strong foundation for lifelong sustainable practices, ensuring that future generations are equipped to address environmental challenges and contribute to a sustainable future. This comprehensive approach to sustainability education, starting from the earliest stages of learning, is essential for achieving the goals of responsible consumption and production as outlined in SDG 12.

The kindergarten we visited faces a significant issue regarding needing more knowledge about plastic waste. This lack of awareness is the primary problem. Improper disposal of plastic waste, such as plastic bottles, can lead to environmental pollution. Therefore, the kindergarten students must care about and protect the environment. The Ar-Rasyid kindergarten students need to understand the proper methods for managing plastic waste. They are unaware that used plastic bottles have practical value. In this case, used plastic bottles can be repurposed as storage containers for stationery at Ar-Rasyid kindergarten.

Game-based solutions have emerged as an effective strategy to engage and motivate children, making learning about plastic pollution and sustainable practices more interactive and impactful (Vecchio & Greco, 2023). By implementing these educational strategies, we can empower children to actively reduce plastic waste, thereby contributing to the broader goal of responsible consumption and production. This comprehensive approach teaches children the importance of the 3R principles and fosters lifelong sustainable habits that can lead to significant environmental benefits.

2. Community Development Method

The community service team collaborated with Ar-Rasyid Kindergarten to conduct an awareness program for the children. This location was chosen because the children at Ar-Rasyid Kindergarten needed to understand proper plastic waste management. This activity aimed to ensure that future generations could protect their environment, aligning with SDG 12, which focuses on responsible consumption and production.

The community development initiative at Ar-Rasyid Kindergarten was designed to educate young students about plastic waste management through theoretical and practical learning experiences. This initiative involved 32 students, including 10 from Kindergarten Class A, 9 from Kindergarten Class B1, and 13 from Kindergarten Class

B2. The community service team consisted of 5 students from Universitas Pembangunan Jaya, guided by a lecturer specializing in the Sustainable Development course.

The preparation for this initiative spanned one semester. During this period, the team developed the educational materials, designed the hands-on activities, and coordinated with the kindergarten staff to ensure the program's smooth execution. The actual implementation of the activities was conducted over one day. This structured approach ensured that the children learned about plastic waste management and gained practical recycling skills, fostering a sense of environmental responsibility from an early age.

The methodology for this community development initiative involved a series of structured activities designed to educate young students about plastic waste management through a combination of theoretical and practical learning. The steps were as follows: First, collaboration and selection of location. The community service team collaborated with Ar-Rasyid Kindergarten, a location chosen due to the need for students to understand proper plastic waste management. Second, pre-test**.** A pre-test was conducted to assess the children's initial knowledge of the 3R principles (Reduce, Reuse, Recycle) related to managing PET plastic bottle waste. Third, material presentation. An educational session was held, during which the team presented materials explaining how to manage PET plastic bottle waste using the 3R principles. Fourth, hands-on workshop. To reinforce the theoretical knowledge, the children were guided through a hands-on workshop where they created crafts from PET plastic bottles. This practical activity helped solidify their understanding of recycling and repurposing waste materials. Fifth, documentation. The entire process, from the pre-test, educational sessions, and the hands-on workshop, was documented to capture the activities and their impact on the children's awareness and understanding. Sixth, post-test. A post-test was conducted to measure the improvement in the children's knowledge and comprehension of the 3R principles after participating in the activities.

Following the method above, the activity implementation method began with a pre-test to assess the children's knowledge about the 3R principles (Reduce, Reuse, Recycle) in managing PET plastic bottle waste. This was followed by a material presentation explaining the management of PET plastic bottle waste by applying the 3R principles. After the presentation, to reinforce the learning, the children were guided in creating crafts from PET plastic bottles. The entire process was documented to capture the awareness activities. By structuring the program this way, the team aimed to provide theoretical knowledge and practical experience, reinforcing the importance of the 3R principles in everyday life. Finaly, a post-test was conducted to measure the children's knowledge improvement.

3. Results community development

Figure 1 illustrates the community service team instructing kindergarten students and administering a pre-test to gauge their comprehension of repurposing plastic bottle waste into pencil cases, thereby mitigating plastic pollution. This activity aimed to

educate young students on the importance of environmental conservation through practical and creative methods.

Figure 1. Team instructing kindergarten students and administering a pre-test

The community service team guided the kindergarteners step-by-step, ensuring they grasped the concept and process of transforming plastic waste into valuable items. The pre-test served as a tool to evaluate the effectiveness of the instructions and the students' initial understanding. This initiative promoted environmental awareness among children and encouraged them to think innovatively about recycling and waste management.

Figure 2. Team taught how to turn plastic into pencil holders

Figure 2 illustrates the community service team instructing kindergarten students to transform plastic bottle waste into pencil holders. This activity aimed to raise students' awareness of the importance of recycling and environmental conservation. The community service team provided clear, step-by-step guidance to help the children understand the process of repurposing plastic waste. This hands-on activity not only engaged the students creatively but also imparted valuable lessons on sustainability and responsible waste management. The students had a lot of fun and enjoyed the

activity, making them feel happy and excited. By teaching the children how to create useful items from waste materials, the initiative encouraged them to think critically about recycling and its impact on reducing pollution.

Figure 3. Pencil holders made from plastic waste by kindergarten students

Figure 3 illustrates the results of a project initiated by our kindergarten students and guided by our esteemed community service team. Together, they turned plastic bottles into pencil holders, a tangible demonstration of recycling principles in action. The community service team's guidance enabled the kindergarten students to transform plastic waste into functional pencil holders. This activity fostered creativity and taught valuable lessons about environmental conservation and responsible waste management. By actively participating in creating valuable items from recycled materials, the students learned firsthand the importance of reducing plastic pollution and contributing positively to sustainability efforts in their community.

Figure 4. The top creators are awarded with a commendation pin

Figure 4 illustrates the awarding of commendation pins to kindergarten students who produced the best pencil holders from used plastic bottles. This recognition highlights their exceptional creativity and skill in repurposing materials for practical use. The award ceremony not only celebrates the students' achievements but also underscores the crucial importance of environmental awareness and sustainable practices. By acknowledging and rewarding their efforts in creating functional items from recycled materials, the event encourages continued engagement in eco-friendly behaviors among young learners. This initiative aims to inspire other students to follow suit, fostering a culture of innovation and responsibility toward environmental stewardship within the school community.

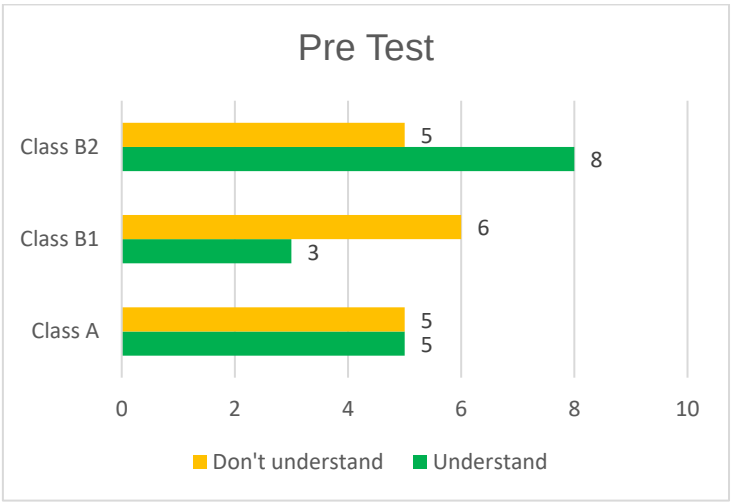

Figure 5. Pre-Test Result

Before conducting the activities, a pre-test was administered to assess the kindergarten students' understanding of plastic waste and their behaviors toward it. This initial assessment aimed to gauge their baseline knowledge regarding the proper disposal and potential reuse of plastic waste, such as transforming it into items like pencil holders. After completing all activities, a post-test was conducted to evaluate the student's understanding after receiving training and guidance. The post-test measured the effectiveness of the educational interventions in enhancing their awareness and knowledge about plastic waste management and recycling practices.

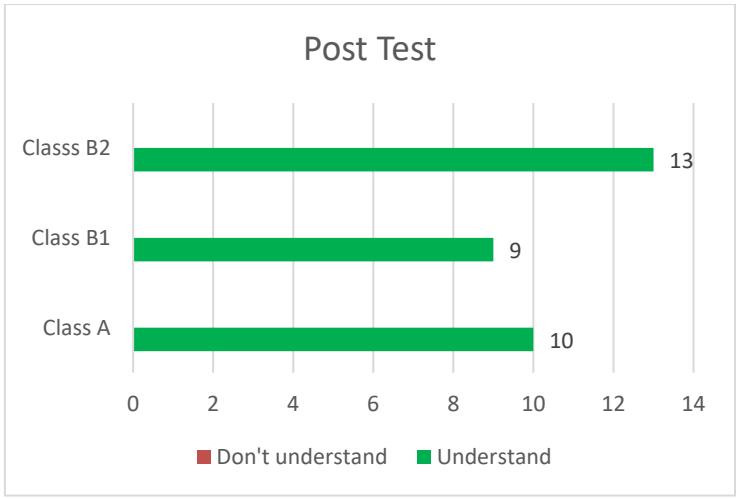

Figure 6. Post Test Result

The pre-test provided valuable insights into the students' initial understanding and awareness gaps related to environmental conservation practices. It identified areas where educational efforts could be focused to promote sustainable behaviors from an early age. In contrast, the post-test results reflected the impact of the training sessions in improving the students' comprehension and practical skills regarding plastic waste recycling and creative reuse. Undoubtedly, the pre-test and post-test assessments were pivotal in evaluating the effectiveness of the educational activities. They not only showcased the progress made by the students but also underscored the significance of continuous efforts in instilling environmental consciousness and responsible waste management practices among young learners.

Figure 5 presents the initial understanding of plastic waste management in TK Ar-Rasyid Class B2, as assessed through a pre-test. All 13 students understood the basic concept of disposing of trash in designated bins. However, five students initially needed to grasp the idea of recycling or creatively reusing plastic waste. After the coaching sessions and subsequent post-test evaluation, Figure 6 demonstrates a significant improvement. All students in Class B2 now have a comprehensive understanding of these concepts, indicating the effectiveness of the coaching sessions.

Similarly, Figure 5 illustrates the pre-test results for Class B1. Out of nine students, six needed to grasp the concept of recycling plastic waste for creative purposes initially, while only three did. After the coaching sessions and post-test, Figure 6 reveals that all students in Class B1 understood these matters.

Furthermore, Figure 5 presents the pre-test findings for Class A, with 10 students involved. Among them, 5 students did not initially understand the potential for plastic waste recycling or creative reuse, such as converting it into pencil holders. However, after the coaching sessions and post-test assessment, Figure 6 demonstrates a comprehensive understanding. All students in Class A have developed a clear understanding of these concepts, indicating the success of the coaching sessions. These results highlight the effectiveness of the coaching sessions in enhancing students' awareness and knowledge about plastic waste management and recycling, leading to significant improvements in understanding among all three classes.

The initiative at Ar-Rasyid Kindergarten, where children learn to manage plastic waste and create pencil holder crafts from plastic bottles, is a commendable effort aligned with broader strategies to combat plastic pollution and foster environmental sustainability. This hands-on approach educates young minds about the significance of waste management and instills a sense of environmental responsibility from an early age. Such educational activities are crucial as they contribute to a cleaner and healthier environment for future generations. The enthusiasm shown by the children in managing plastic waste reflects the positive impact early education can have on pro-environmental behaviors. This activity indicating that perspective-taking messages can increase empathy and guilt, promoting the 3Rs (reduce, reuse, recycle) behaviors (Yan & Cortese, 2023).

Moreover, the importance of environmental knowledge in shaping behavior is highlighted by studies showing a positive correlation between environmental

knowledge and the use of biodegradable plastics among students (Pravitasari et al., 2022). The transition to a circular economy, emphasizing the reuse of materials, further underscores the significance of such educational activities in waste management (Freudenthaler et al., 2023). Effective waste management, including plastics, is essential for optimal resource utilization, as indicated by studies on zero waste management behavior (Coskun, 2022). The role of public awareness and knowledge in waste management is crucial and empowering, demonstrated by the significant positive correlation between public awareness and waste management behaviors (Zhou et al., 2022).

The impact of household activities, such as dishwashing, on microplastic pollution highlights the need for more environmentally friendly practices and materials (Sol et al., 2023). The food industry's role in producing plastic packaging waste and the need for sustainable packaging alternatives emphasize the importance of reducing plastic waste (Piracci et al., 2023). Attitudes and behaviors towards disposable plastic tableware illustrate the need for effective waste management strategies (Ho et al., 2023). The involvement of citizens in policymaking, as recommended for the UN treaty on plastic pollution, highlights the importance of public participation in addressing environmental issues (Oturai et al., 2023). Lastly, studies on the crystallization kinetics of recycled plastics underscore the potential for recycling and upcycling plastic waste, which is essential for mitigating plastic pollution's environmental impact (Barati et al., 2023).

Lastly, studies on the crystallization kinetics of recycled plastics underscore the potential for recycling and upcycling plastic waste, offering a hopeful solution for mitigating the environmental impact of plastic pollution. The activity at Ar-Rasyid Kindergarten represents a microcosm of global efforts to manage plastic waste and promote sustainability, demonstrating that early education and public awareness are key to creating a cleaner and healthier environment for future generations.

4. Conclusion

The community development initiative at Ar-Rasyid Kindergarten has demonstrated significant strides in educating young students about plastic waste management and promoting environmental stewardship. Through hands-on activities guided by the community service team, kindergarten students transformed plastic bottle waste into practical items like pencil holders.

The activities began with pre-tests to assess students' initial understanding of plastic waste disposal and recycling concepts. These tests revealed varying levels of comprehension among students across different classes. However, after participating in educational sessions and hands-on activities, all students showed marked improvement in their understanding and practical skills in recycling plastic waste.

These activities fostered creativity and practical skills and instilled a sense of environmental responsibility among young learners. By actively empowering students to participate in waste management practices and recycling efforts, the initiative promotes a sustainable mindset from an early age.

Furthermore, the positive outcomes observed in this initiative underscore the importance of early education in shaping pro-environmental behaviors and fostering a cleaner, healthier environment for future generations. Such efforts are crucial in addressing global challenges related to plastic pollution and promoting the principles of reduce, reuse, and recycle within communities.

In conclusion, the Ar-Rasyid Kindergarten initiative exemplifies how targeted educational interventions can empower young children to become proactive environmental stewards. It also underscores the importance of continued efforts to integrate environmental education into early childhood curriculum. These efforts will play a pivotal role in building a sustainable future, and it is crucial that we all remain committed to this cause.

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