Islamic Journal of Integrated Science Education (IJISE), Vol. 3 No. 3, November 2024, pp. 132-145
DOI: https://doi.org/10.30762/ijise.v3i3.3596

Islamic Journal of Integrated Science Education (IJISE)

Program Studi Tadris IPA
Universitas Islam Negeri (UIN) Syekh Wasil Kediri
e-ISSN : 2986-0865
https://jurnalfaktarbiyah.iainkediri.ac.id/index.php/ijise

3R ACTIVITIES AND THEIR EFFECTS ON SCIENCE LEARNING IN MALAYSIAN NATIONAL SCHOOLS

Titik Rahayu[1*], Nurul Setiana[2]
[1]National University of Malaysia, Bangi, Selangor Malaysia
[2]State Islamic University Raden Intan Lampung, Lampung

***Correspondence E-mail:** rahayutitik77@gmail.com

Abstract: This research investigates the impact of Reduce, Reuse, and Recycle (3R) activities on science education in Malaysian national schools. The study uses a qualitative case study approach, collecting data from 45 subjects, including primary school teachers, secondary school teachers, and students. The results show high enthusiasm among teachers and students for implementing the 3Rs in education, despite challenges. The study found that 3R activities are effective in teaching science in a simple and efficient way, encouraging creativity, improving motor development, and encouraging wise use of used goods. The findings suggest that using Reduce, Reuse, and Recycle (3R) activities in science education contributes to environmental education. Future research is recommended to determine the differences and impacts of 3R implementation on science learning, as this research has the potential to significantly impact environmental and sustainability education globally.

Keywords: Science learning, Environmental education, 3R effects

Article History:
Received: 27 August 2024; Revised: 20 November 2024; Accepted: 21 November 2024; Published: 21 November 2024

Citation (APA Style):
Rahayu, T., & Setiana, N. 3R Activities and Their Effects on Science Learning in Malaysian National Schools. *Islamic Journal of Integrated Science Education (IJISE), 3*(3). https://doi.org/10.30762/ijise.v3i3.3596

Copyright : © 2024 by the authors. This is an open access publication under the terms and conditions of the Creative Commons Attribution - ShareAlike 4.0 International License (CC BY SA) (https://creativecommons.org/licenses/by-sa/4.0/).

INTRODUCTION

Everyone must protect the environment, because it is home to all life forms, especially humans. Human life is greatly influenced by the quality of the environment (Supardi, 2023). Therefore, humans need to make good use of the environment, all used and unused goods are processed in such a way that they have benefits in human life. Making use of unused goods for example through community-based waste processing 3R (Reduce, Reuse, Recycle) aims to reduce waste from its source, reduce environmental pollution, produce benefits for the community and can change the community's behavior regarding waste (Putra et al., 2022). Therefore, Community life must show a lot of concern for the environment through a person's response to it (Faishol et al., 2021). When this can be done well, eating will create a clean and beautiful environment (Tamara, 2016).

A clean and beautiful environment gives a positive impact in life, especially in the world of education. In general, education means the process of self-development of each individual to live his life. Until we become someone who is educated, we are educated to be useful people for the nation and the country (Nurhadi et al., 2023). Currently, awareness of environmental protection is increasing, especially among the younger generation. However, the awareness initiative still cannot provide protection results that have an impact on the environment (Mohd Zain et al., 2022). As in Banchonhattakit's study (2022) that the effects of environmental damage done by humans will return to humans (Banchonhattakit et al., 2022). Therefore, in education, it is necessary to provide education to students so that students have a sense of love and the importance of caring for the environment. As according to Surtahman Kastin Hasan (2018) that the environment is very important in life because it can benefit humans. Thus, awareness is needed for academic citations in paying attention to the environment. According to Fazli Sabri and Teoh Yong Yong (2006) and Mustafar, F. W., et al. (2020) suggested that the curriculum at the primary or secondary school level in the future needs to be applied by adding lessons in the syllabus in the education system to provide knowledge at an early stage so that awareness in environmental care can be realized. One of the activities to support environmental care at school is to make use of used items.

The 3R activity (Reduce, Reuse, Recycle) refers to three main concepts, namely reducing the use of resources and waste production by minimizing the consumption of goods and energy, reusing unused goods, and processing waste materials to produce new materials that can be used. return (Abidin et al., 2022; Fitria et al., 2022; Heleni Fitri. et al., 2020). Reduce, Reuse, Recycle can minimize the negative impact of manufacturing, greenhouse gas effects and retail on the environment (Banchonhattakit et al., 2022; Radhakrishnan, 2016), and provide an

understanding of the key factors of behavior that can help develop strategies that help optimize waste management (Escario, 2020). 3R is one of the most effective waste minimization strategies, to reduce the waste thrown into landfills (Kabirifar et al., 2020; Park & Tucker, 2017; Yuan & Shen, 2011).

Awareness of the environment needs to be instilled in society and even in students at school (Rubiantoro & Susilowati, 2023). The behavior of protecting nature must continue to be applied to the new generation in order to encourage environmentally friendly living behavior (Redondo & Puelles, 2017). Basically, the new generation already knows the 3Rs, but participation in the program is still relatively low (Haliza, 2020). Muarifa, 2023 revealed that most students already know about the processing of the 3R method, but this method is still not optimal in its application. Human activity has a significant impact on global climate change and the development of new public health problems. For example, the use of plastic and foam packaging in marketing food and other products encourages the use of fossil materials and petroleum-derived products, and waste disposal can cause environmental degradation and toxicity (Banchonhattakit et al., 2022; Lee & Manfredi, 2021). Amri and Widyantoro show that waste management requires a lot of individual behavior formation (Amri, 2017). Bandura's 1982 self-efficacy theory presents the individual's role towards the environment guided by internal perception. Each individual has their own thoughts, feelings, and desires. Confidence in self-efficacy has an impact on the environment through the process of self-motivation. (Musser & Leone, 1992). Children who have high self-efficacy and internal locus of control will have the purpose of behaving and behaving lovingly towards the environment (Malkus & Musser, 1993).

In most research on waste management in primary schools only apply 3R without involving science learning in it for example (Abidin et al., 2022; Aguilar-Jurado et al., 2019; Banchonhattakit et al., 2022; Gutiawati et al., 2022b; Heleni Fitri et al., 2020; Nurfurqon, 2021; So & Chow, 2014). Students in primary and secondary schools are at least able to master basic science process skills. In learning science, students are not only required to master science concepts (products), but also pay attention to practices, processes and attitudes. Through the practicum, students have the opportunity to develop and apply science process skills, scientific attitudes to acquire knowledge (Fauth et al., 2019; Leuchter et al., 2014). Learning science is important because it can be the basis of conceptual knowledge for understanding advanced scientific concepts (Ruthven et al., 2009).

Research related to the application of 3R and its influence on science learning in primary schools has not been specifically found. Previous research linked 3R with the implementation

process of 3R in primary schools (Rudiyanto et al., 2021), linked Recycle used bottles as learning media in IPS (Nurfurqon, Kelana, 2023), linked 3R in empowering creativity (Abidin et al., 2022; Gutiawati et al., 2022a), linking Recycle education with environmental pollution in primary schools (Aguilar-Jurado et al., 2019), linking 3R to school network interventions (Banchonhattakit et al., 2022), linking Recycle with economic learning media (Heleni Fitri. et al., 2020), linking 3R with children's attitude towards the environment (Malkus & Musser, 1993), linking plastic resources and recycle with environmental education (So & Chow, 2019), the implementation of the Recycle program in primary schools (Ward et al., 2014). For that reason, this research tries to explore in depth related to science learning in primary schools using 3R (Reduce, Reuse, Recycle) activities.

METHOD

This research uses a case study qualitative research methodology (multiple Case Design-Embedded multiple unit of analysis) (Creswell & Creswell, 2018; Robert K. Yin, 2018). multiple case design refers to the 3R factivity and science learning. Embedded multiple unit of analysis refers to the data mining process for two Malaysian national elementary and junior high schools. The use of this research design to obtain comprehensive and in-depth data related to 3R activities and their influence on science learning, which is the main purpose of this research (Chesebro & Borisoff, 2007; Creswell & Creswell, 2018; Robert K. Yin, 2018).

Data was collected through in-depth interviews, non-participant observation and document analysis. In-depth interviews on 10 subjects consisting of 10 elementary school teachers and 2 middle school teachers with experience in the subjects of 3 IPA, 3 Mathematics, 3 English, and 1 Malay. In-depth interviews with teachers dig up information related to implementation activities, impacts, and challenges in 3R activities in Malaysian national schools. Non-participant observation, the researcher witnessed directly in the field related to 3R activities in schools. In the context of observation, the researcher observes the school situation related to the physical environment, the atmosphere, the dynamics of daily activities, the method used in the delivery of material, the interaction between teachers and students, with the subjects being observed being 35 students and 10 teachers. Document analysis, performed on various documents, such as; RPP and activity photos. A detailed description of sources, how to collect data, and the amount of data sources as shown in **Table 1**.

Table 1. A detailed description of the sources, how to collect data, and the amount of data sources

Source Data	Collection Techniques	Amount
Research Subject	▪ Observation ▪ Interview	▪ Elementary school teachers, middle school teachers and students - Elementary and middle school teachers
	Documentation	RPP and Photos of activities

In this research, data was collected through interviews, observations, and document analysis. All the data obtained were analyzed using the Iterative qualitative data analysis model (Miles and Huberman, 2014). The analysis process is done in a systematic and structured way to find concrete research findings. So that the results of the analysis can provide a comprehensive and in-depth understanding of the 3R activities and their influence on science learning at school. The research results can be used as a basis for the implementation of 3R in science learning to be more effective and efficient for students (Miles & Huberman, 1994).

FINDING AND DISCUSSION

3R activities at the National School of Malaysia

Based on the results of the analysis of the research data, there is a finding of this research in the implementation of the TripleR (Reduce, Reuse, Recycle) activity in the Malaysian national school, which is very enthusiastic and earnest to apply 3R in learning both from the teacher and the students. However, in its implementation, there are challenges in the lack of resources and materials as well as the lack of time in planning PdPc, lack of awareness and interest in practicing what is learned in environmental education among students.

In his activities, the teacher gives instructions related to the activities to be carried out, the teacher motivates students related to environmental education through environmental education activities. Some teachers are of the opinion to integrate elements of environmental education into the syllabus for all subjects, using the project method, using ICT or making online quizzes and the provision of environmental lovers' clubs as an application of 3R (Reduce, Reuse, Recycle) activities. Here are the results of the Reduce, Reuse, Recycle activities implemented in Malaysian national schools as follows **Table 2**.

Islamic Journal of Integrated Science Education (IJISE), Vol. 3 No. 3, November 2024, pp. 132-145
DOI: https://doi.org/10.30762/ijise.v3i3.3596

Table 2. 3R activity

Activities 3R	Material	Concept	The work of 3R
Flowery Egg	Paper	Cheerfulness	
Beautiful Wall Décor	Paper	Cheerfulness	
Recycled Paper	Paper	Science	
Flower Bloom	Aluminum Cans and Steel Cans	Cheerfulness	
mr. Save Tin	Aluminum Cans and Steel Cans	Cheerfulness	
Tin Phone	Aluminum Cans and Steel Cans	Science	

Broom	Plastic	Cheerfulness	
Coin Wallet	Plastic	Cheerfulness	
Water Filters	Plastic	Science	

3R effects for science learning

3R-based environmental education has an impact on science learning in Malaysian national schools, including:

1. 3R teaches science in a simple and effective way to student

Overall, students feel happy doing 3R activities, because these activities can reveal simple science concepts to them, this shows that learning with the project method can be accepted and understood more quickly by students, while learning is going on, the teacher should explain the importance of taking care of the environment, so that Adolescent awareness of the environment can continue to grow. Education is used to acquire knowledge, change attitudes and develop skills in resource management, including waste management (Fredrick et al., 2018). Education, as a significant and simple way to solve the problem of waste, leads to increased environmental awareness and the planning of the right solutions for sustainable development (Przydatek, 2019). Education from an early age ensures that future generations contribute to sustainable waste management practices (Zainu & Songip, 2017). Therefore, it is important to socialize waste management education starting from kindergarten. In this context, the role and responsibility of each individual in waste management must be communicated and

given precise instructions. In this way, the community that is responsible for managing waste as a resource and producing zero or less waste in the future can rise by applying the 3R rules (Dharmasiri, 2019).

2. Students become more creative

Students can also show their creativity in producing the desired product. The Reduce, Reuse, recycle method encourages students to practice creative thinking by utilizing available materials and reducing waste. Students not only learn about the processing of used materials but also develop innovative skills that can be applied in various aspects of their lives. The creativity that emerges from the use of the 3R method enriches the learning process and produces unique, practical, and aesthetic products. Mat Nasir Yahaya Buntat and Noor Sharliana (2011), The main factor that affects student creativity is knowledge. Therefore, efforts to learn through recycling operations can increase students' knowledge while creating an environment that can increase their level of creativity (Buntat et al., 2011).

3. Children's motoric development is better trained

There are activities that are simple and suitable for primary school students. However, for activities with a relatively high level of difficulty, it is necessary to be guided because motor skills such as holding scissors and cutting are still in the development stage. Chen's research (2016) highlights that recycling education is not only beneficial to protect the environment but also contributes to physical activities that support motoric competence and movement patterns. Children who are involved in recycling activities, such as collecting, sorting, and recycling items, indirectly improve their fine and gross motor skills. This is important for the development of movement patterns such as coordination, balance, and agility. (Chen, 2016). Hodson (1998) explains that teaching practices that involve children actively play a role in three main domains: cognitive, affective, and psychomotor. By engaging in activities related to recycling, children not only develop their intellectual abilities (cognitive), but also improve emotional awareness (affective) and motor skills (psychomotor). For example, they learn to think critically about environmental impacts and become emotionally involved in protecting nature (Hodson, 1998). According to Muljaningsih and Galuh (2018), the practice of waste management not only has an impact on improving children's cognitive skills in understanding the recycling process but also improves emotional aspects through concern for the environment, as well as psychomotor skills in performing physical activities related to waste management. The activity can involve physical actions that encourage the development of coordination and fine motor skills (Muljaningsih & Galuh, 2018). By integrating recycling in education, children can obtain

holistic benefits that involve various aspects of development, from physical to emotional and intellectual.

4. Encourage students to optimize the use of second-hand goods so that they can be recycled wisely

Activities carried out using second-hand materials directly educate the students that second-hand and waste items found around them also have various other uses. The concept of zero waste and recycling activities is a universal achievement that is important to shape the future of a country and create a cleaner environment for future generations (Bulut, 2020). However, the amount of waste produced continues to increase without the conscious decision of consumers to reduce, reuse, and recycle (Zainu & Songip, 2017). Ampofo (2020) states that high school students, teachers, and administration are concerned about waste disposal When a study on the effectiveness of environmental education and waste management practices is examined (Amfofo, 2020). Liao. & Li (2019) revealed that environmental education is very important to ensure that high school students have the necessary knowledge and a positive attitude towards solid waste sorting (Liao & Li, 2019). Likewise, the results of his research, Nizaar et al. (2020) revealed that waste processing activities carried out using the 3R rule are also effective in increasing students' environmental awareness (Muhammad, 2020).

CONCLUSION

Based on the results of this research, it can be concluded that the application of 3R activities (Reduce, Reuse, Recycle) in science learning in Malaysian national schools has a significant positive impact, despite being faced with several challenges. The following is the main conclusion: Teachers and students show high enthusiasm in applying the 3R principles in learning. However, there are several challenges, such as limited resources and materials, as well as the lack of awareness and interest of students to practice environmental education in a sustainable manner. The application of 3R in science education is proven to be effective in simplifying the concept of science, so that it is easier for students to understand. This method also succeeded in increasing student involvement in learning, by using a deep and practical project approach. 3R activities encourage students to think creatively and innovatively in making use of used materials. 3R activities play a role in the development of students' motor skills, especially in activities that involve the use of hands such as cutting and arranging recycled materials. Through 3R activities, students learn to be wiser in using used items, encouraging them to optimize the use of resources on a sustainable basis. The research results contribute significantly to the development of environmental education through the application

of Reduce, Reuse, Recycle (3R) activities in science learning at school. Future research is recommended a comparative study between Malaysian national schools and other schools, to see the differences in the implementation of 3R and its impact on science learning. This research can provide a global insight into the application of environmental education and sustainability.

REFERENCES

Abidin, R., Sumriyeh, S., & Asy'ari, A. (2022). Metode Pembelajaran Berbasis 3r (Reuse, Reduce, Recycle) dalam Upaya Memperdayakan Kreativitas Anak Usia Dini. *Jurnal Pelita PAUD*, *6*(2), 222–231. https://doi.org/10.33222/pelitapaud.v6i2.1732

Aguilar-Jurado, M. Á., Gil-Madrona, P., Ortega-Dato, J. F., & Zamorano-García, D. (2019). Effects of an educational glass recycling program against environmental pollution in Spain. *International Journal of Environmental Research and Public Health*, *16*(24). https://doi.org/10.3390/ijerph16245108

Ampofo, J. A. (2020). Waste disposal management practices in selected senior high schools within the Wa Municipality of Ghana. *International Journal of Management & Entrepreneurship Research*, *2*(4), 273–290.

Amri, W. (2017). Pendampingan Pembelajaran Memilah Dan Menempatkan Sampah Pada Tempatnya Sejak Usia Dini Di TK Imbas 1. *International Journalof Community Service Learning*, *1*, 121–126.

Banchonhattakit, P., Inmuong, U., Duangsong, R., Phimha, S., Prachaiboon, T., & Padchasuwan, N. H. (2022). Effects of a school-network intervention using Reduce, Reuse and Recycle in Thailand. *Health Education Journal*, *81*(3), 363–371. https://doi.org/10.1177/00178969221079024

Bulut, A. (2020). Teacher opinions about children's awareness of zero-waste and recycling in the pre-school education years. *Review of International Geographical Education Online*, *10*(3), 351–372.

Buntat, Y., Nasir, N. S. M., & Sharliana, N. (2011). Faktor-faktor yang mendorong kreativiti di kalangan pelajar, Universiti Teknologi Malaysia. *Journal of Educational Psychology and Counseling*, *2*(1), 175–208.

Chen, Y. (2016). Trash to treasure: Using recyclables in physical activity settings. *Journal of Physical Education, Recreation & Dance*, *87*(7), 45–51.

Chesebro, J. W., & Borisoff, D. J. (2007). What Makes Qualitative Research Qualitative ? *Qualitative Research Reports in Communication*, *8*(1), 3–14. https://doi.org/10.1080/17459430701617846

Creswell, W. J., & Creswell, J. D. (2018). Research Design: Qualitative, Quantitative and Mixed Methods Approaches. In *SAGE Publications*.

Dharmasiri, L. M. (2019). Waste management in Sri Lanka: challenges and opportunities. *Sri Lanka Journal of Advanced Social Studies*, *9*(1), 72–85.

Escario, et. a. (2020). The influence of environmental attitudes and perceived effectiveness on recycling, reducing, and reusing packaging materials in Spain. *Waste Management*, *10*(1), 54–75.

Faishol, R., Meliantina, M., Ramiati, E., Putri, E. I. E., & Rahayu, S. M. (2021). Pendampingan Kegiatan Pembelajaran Siswa Dengan Memanfaatkan Barang Bekas Untuk Meningkatkan Minat Dan Kreativitas Belajar Pada Masa Pandemi Covid-19. *ABDI KAMI: Jurnal Pengabdian Kepada Masyarakat*, *4*(1), 092. https://doi.org/10.29062/abdi_kami.v4i1.519

Fauth, B., Decristan, J., Decker, A. T., Büttner, G., Hardy, I., Klieme, E., & Kunter, M. (2019). The effects of teacher competence on student outcomes in elementary science education: The mediating role of teaching quality. *Teaching and Teacher Education*, *86*. https://doi.org/10.1016/j.tate.2019.102882

Fitria, K., Kristiana, D., & Setyowahyudi, R. (2022). Edupreneurship Berbasis 3R (Reduce, Reuse, dan Recycle) Sebagai Upaya Mensejahterakan Ekonomi Pendidik PAUD. *Aulad: Journal on Early Childhood*, *5*(2), 273–279. https://doi.org/10.31004/aulad.v5i2.380

Fredrick, M., Oonyu, J. C., & Sentongo, J. (2018). Influence of education on the solid waste management practices of communities in Kampala city. *Journal of Environment and Waste Management*, *5*(1), 261–274.

Gutiawati, T. A., Kristiana, D., & Setyowahyudi, R. (2022a). Metode 3R (Reduce, Reuse, Recycle); Kreativitas; anak usia dini. *Jurnal Ilmiah Potensia*, *7*(1), 46–55.

Gutiawati, T. A., Kristiana, D., & Setyowahyudi, R. (2022b). Penerapan Metode 3R (Reduce, Reuse, Recycle) Untuk Menstimulasi Kreativitas Pada Anak Usia Dini di Kelompok A. *Jurnal Ilmiah Potensia*, *7*(1), 46–55. https://doi.org/10.33369/jip.7.1.

Haliza, A. R. (2020). Malaysian Youth and Environmental Sustainability: A Review Belia. *Perspektif: Jurnal Sains Sosial Dan Kemanusiaan*, *12*(2), 43–54.

Heleni Fitri. dkk. (2020). Media Pembelajaran Bernilai Ekonomis Berbasis Recycle System untuk Pendidikan Anak Usia Dini. *Jurnal Obsesi : Jurnal Pendidikan Anak Usia Dini*, *4*(2), 813–819. https://doi.org/10.31004/obsesi.v4i2.296

Hodson, D. (1998). *Teaching and learning science: Towards a personalized approach*. McGraw-Hill Education (UK).

Kabirifar, K., Mojtahedi, M., Wang, C., & Tam, V. W. Y. (2020). Construction and demolition waste management contributing factors coupled with reduce, reuse, and recycle strategies for effective waste management: A review. *Journal of Cleaner Production*, *263*(May). https://doi.org/10.1016/j.jclepro.2020.121265

Lee, S., & Manfredi, L. R. (2021). Promoting recycling, reducing and reusing in the School of Design: a step toward improving sustainability literacy. *International Journal of Sustainability in Higher Education*, *22*(5), 1038–1054. https://doi.org/10.1108/IJSHE-11-2020-0443

Leuchter, M., Saalbach, H., & Hardy, I. (2014). Designing Science Learning in the First Years of Schooling. An intervention study with sequenced learning material on the topic of "floating and sinking." *International Journal of Science Education*, *36*(10), 1751–1771. https://doi.org/10.1080/09500693.2013.878482

Liao, C., & Li, H. (2019). Environmental education, knowledge, and high school students' intention toward separation of solid waste on campus. *International Journal of Environmental Research and Public Health*, *16*(9), 1659.

Malkus, A. J., & Musser, L. M. (1993). Children and the new 3 Rs (reduce, reuse, recycle): Attitudes toward the environment. *Policy*, *11*.

Miles and Huberman. (2014). Qualitative Data Analysis Edition 3. In *SAGE Publications* (Vol. 13, Issue 1).

Miles, M., & Huberman, M. (1994). Qualitative data analysis: Second Edition. In *SAGE Publications* (Vol. 1304).

Mohd Zain, N., Anua, S. M., Marzuki, N. S., & Abdul Rahman, H. (2022). A Comparative Study on the Effectiveness of 3R (Reuse, Reduce and Recycle) Programme among Primary School Students in Tumpat, Kelantan. *International Journal of Academic Research in Business and Social Sciences*, *12*(14). https://doi.org/10.6007/ijarbss/v12-i14/15823

Muhammad, N. (2020). Improving Students' Environmental Awareness Using 3R Principles. *Universal Journal of Educational Research*, *8*(11B), 6146–6151.

Muljaningsih, S., & Galuh, A. K. (2018). Intention model of waste management education concept based on green campus in Brawijaya University. *Indonesian Journal of Environment and Sustainable Development*, *9*(2).

Musser, L. M., & Leone, C. (1992). Moral character: A social learning perspective. *Psychological Foundations of Moral Education and Character De-Velopment: An Integrated Theory of Moral Development*, *2*, 141.

Nurfurqon, Kelana, P. (2023). improving elementary school students enviromental care skillsin ultilizing plastic bottles as social science learing media. *Jurnal Cakrawala Pendas*, *9*(1), 190–196.

Nurhadi, W. S. P., Permana, G. P. L., Darma, I. M. W., Sutama, I. W., Gorda, A. S. R., & Martini, I. A. O. (2023). Edukasi Metode Pengolahan Sampah 3R (Reduce, Reuse, Recycle) Kepada Siswa SD Negeri Nomor 4 Desa Tiga dengan Media Majalah Dinding. *Mattawaing : Jurnal Pengabdian Masyarakat*, *4*(2), 2–7. https://doi.org/10.35877/454RI.mattawang1580

Park, J., & Tucker, R. (2017). Overcoming barriers to the reuse of construction waste material in Australia: a review of the literature. *International Journal of Construction Management*, *17*(3), 228–237. https://doi.org/10.1080/15623599.2016.1192248

Przydatek, G. (2019). Waste management in selected national parks–A review. *Journal of Ecological Engineering*, *20*(4), 14–22.

Putra, A. K., Nugraha, P. C. D., Putra, K. D. P., Fadillah, R., Putri, N. M. P. N., & Putri, D. A. P. A. G. (2022). Edukasi Mengenai Sampah Organik Dan Komposting Di Desa Riang Gede. *SELAPARANG: Jurnal Pengabdian Masyarakat Berkemajuan*, *6*(1), 215. https://doi.org/10.31764/jpmb.v6i1.7702

Radhakrishnan, S. (2016). Environmental Implications of Reuse and Recycling of Packaging. *Environmental Footprints and Eco-Design of Products and Processes*, *July*, 165–192. https://doi.org/10.1007/978-981-287-913-4_7

Redondo, I., & Puelles, M. (2017). The connection between environmental attitude–behavior gap and other individual inconsistencies: a call for strengthening self-control. *International Research in Geographical and Environmental Education*, *26*(2), 107–120. https://doi.org/10.1080/10382046.2016.1235361

Robert K. Yin. (2018). *Case Study Research and Applications Sixth Edition* (6th ed.). 2018.

Rubiantoro, E. A., & Susilowati, I. (2023). Pendampingan Tentang Pengolahan Sampah Dengan Prinsip Reduce, Reuse, Recycle (3R) di Sekolah Dasar Negeri (SDN) Jatinegoro, Kelurahan Jatinegoro, Kec Gunung Pati, Kota Semarang. *Merdeka Indonesia Jurnal International*, *3*(1), 69–76.

Rudiyanto, R., Kurniati, E., Fitriani, A. D., Rengganis, I., Mirawati, M., & Justicia, R. (2021). Reduce, Reuse, and Recycle (3R) waste activities in the school environment for elementary school students. *Journal of Physics: Conference Series*, *1987*(1). https://doi.org/10.1088/1742-6596/1987/1/012052

Ruthven, K., Laborde, C., Leach, J., & Tiberghien, A. (2009). Design tools in didactical research: Instrumenting the epistemological and cognitive aspects of the design of teaching sequences. *Educational Researcher*, *38*(5), 329–342. https://doi.org/10.3102/0013189X09338513

So, W. W. M., & Chow, S. C. F. (2019). Environmental education in primary schools: A case study with plastic resources and recycling. *Education 3-13*, *47*(6), 652–663. https://doi.org/10.1080/03004279.2018.1518336

Supardi, S. (2023). CHANGING THE ENVIRONMENTAL PARADIGM THROUGH 3R (Reuse, Reduce, Recycle) EDUCATION: Student Devotion to Plastic Waste Management and Sustainable Creativity with Economical Value. *Jurnal PKM Manajemen Bisnis*, *3*(2), 85–93. https://doi.org/10.37481/pkmb.v3i2.604

Tamara. (2016). Hubungan Antara Lingkungan Sosial Dengan Motivasi Belajar Santri Di Pesantren Madinatul Ilmi Islamiyah. *SPEKTRUM: Jurnal Pendidikan Luar Sekolah (PLS)*, *1*(2), 44–55. https://doi.org/10.24036/spektrumpls.v1i2.2428

Ward, M. N., Wells, B., & Diyamandoglu, V. (2014). Development of a framework to implement a recycling program in an elementary school. *Resources, Conservation and Recycling*, *86*, 138–146. https://doi.org/10.1016/j.resconrec.2014.02.013

Yuan, H., & Shen, L. (2011). Trend of the research on construction and demolition waste management. *Waste Management*, *31*(4), 670–679. https://doi.org/10.1016/j.wasman.2010.10.030

Zainu, Z. A., & Songip, A. R. (2017). Policies, challenges and strategies for municipal waste management in Malaysia. *Journal of Science, Technology and Innovation Policy*, *3*(1), 10–14.