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Enhancing 3R (Reuse, Reduce, Recycle) Awareness through E-Book Design as a Sustainable Waste Management Solution

Galih Indra Permana[1], and Deny Tri Ardianto[2]

[1,2]Visual Communication Design, Faculty of Arts and Design, Sebelas Maret University,
Jl. Ir. Sutami No. 36 A, Surakarta 57126 Indonesia

E-mail: [1]galihindraper24@gmail.com

Abstract

This study entitled "Enhancing 3R (Reuse, Reduce, Recycle) Awareness through E-Book Design as a Sustainable Waste Management Solution" focuses on the development of an educational e-book aimed at increasing public awareness of 3R practices in Indonesia, with Surakarta City as one of the case examples. This research is motivated by the low level of public understanding and implementation of sustainable waste management practices in various regions of Indonesia. The purpose of this study is to design an e-book based on visual communication design principles that is visually engaging, easy to understand, and capable of encouraging the application of the 3R (Reuse, Reduce, Recycle) concept in daily life. A qualitative research methodology was employed, including observation, interviews, questionnaires, and literature review. The results indicate that informative, interactive, and visually consistent visual content delivered through e-book media can effectively enhance public understanding and interest in implementing 3R principles. Therefore, the designed e-book is expected to strengthen public awareness at the national level and serve as an effective educational medium to promote sustainable waste management behavior in Indonesia.

Keywords: *3R Awareness, E-book Design, Sustainable Waste Management, Visual Communication Design*

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INTRODUCTION

Effective and sustainable waste management is a crucial aspect of environmental preservation and the improvement of public quality of life. According to Law Number 18 of 2008 concerning Waste Management, waste management in Indonesia must be implemented comprehensively through waste reduction, reuse, and recycling, known as the 3R (Reduce, Reuse, Recycle) principle. This framework emphasizes collaboration between government and society to establish a participatory, integrated, and long-term sustainable waste management system. These principles align with the national targets set out in the National Policy and Strategy for Household Waste Management (Jakstranas), which aim to reduce waste generation by 30% and manage 70% of waste by 2025.

Despite these regulatory frameworks and policy targets, the implementation of waste management in Indonesia continues to face significant challenges. Data from the National Waste Management Information System (SIPSN) of the Ministry of Environment and Forestry indicate that in 2023, total waste generation reached approximately 31.9 million tons across 290 regencies and cities. Of this total, only about 63.3% of waste was properly managed, while the remaining portion was disposed of without adequate sorting or recycling processes. Such conditions contribute to environmental pollution affecting water, soil, and air quality. The World Health Organization (WHO, 2022) has emphasized that environmental pollution caused by unmanaged waste increases the risk of environment-related diseases, including diarrhea and respiratory infections.

Low public awareness and limited participation in waste management based on the 3R principle further exacerbate this issue. Studies have shown that community involvement in waste sorting and recycling remains insufficient, and many waste management facilities, such as Reduce, Reuse, Recycle Waste Processing Sites (TPS3R), are not functioning optimally. Research conducted by the University of Indonesia in 2025 reported that nearly 90% of TPS3R facilities nationwide operate below expected standards, indicating persistent challenges in public education, infrastructure, and management systems.

Similar waste management problems are also evident in urban areas, including Surakarta City in Central Java. The city generates more than 300 tons of waste daily, with an average of over 400 tons per day disposed of at the Putri Cempo Landfill in 2024, resulting in overcapacity conditions. Although the Surakarta City Government has implemented various programs such as waste banks, climate village initiatives, and neighborhood-level 3R education, their effectiveness remains limited due to low community participation and inadequate understanding of 3R practices. Previous studies indicate that most household waste in Surakarta is not sorted at the source, and the potential of waste banks as educational and empowerment platforms has not been fully utilized.

Various educational approaches have been employed to address waste management issues, including face-to-face socialization, field campaigns, and audiovisual media. However, these approaches often face limitations related to participant reach, time constraints, and dependence on physical presence or specific technological resources. These limitations highlight the need for alternative educational strategies that are more accessible, flexible, and capable of delivering information in an engaging manner. In this context, digital educational media have emerged as a potential solution to support public understanding of sustainable waste management practices

METHOD

The data obtained from observations, interviews, questionnaires, and literature studies were analyzed using a qualitative descriptive method, as this method is used to process and present data in an easily understandable manner and to help identify patterns, themes, or relationships within the collected information (Miles, Huberman, & Saldana, 2014).

The method applied in this design process is design thinking, which is a creative and human-centered design approach aimed at finding innovative solutions to a problem. According to Brown (2008), design thinking integrates empathy, creativity, and rationality to produce solutions that are relevant to user needs. Meanwhile, Dam and Siang (2017) state that design thinking consists of five main stages: empathize, define, ideate, prototype, and test.

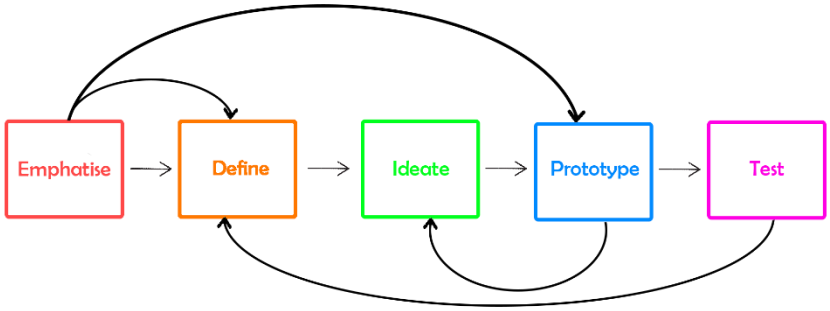

Figure 1. Design Thinking Chart
(Source: https://www.gamelab.id/news/737-design-thinking)

This research focuses on designing an e-book as the main educational medium to increase awareness of the 3R principles (Reduce, Reuse, Recycle). The target audience of the study is the community of Surakarta City, particularly digitally literate young people, specifically individuals aged 17–30 years, both male and female. The research location was determined at the Environmental Agency (Dinas Lingkungan Hidup/DLH) of Surakarta City, as an institution that plays an important role in waste management and environmental education. In addition to the e-book, this research also includes the design of supporting media, such as keychains and other printed media, as visual elements to reinforce the message.

a. Empathize

The first stage involves understanding the problems faced by the community related to the low level of awareness in applying the 3R principles. Observations and interviews were conducted with community members as well as with representatives of the Environmental Agency (Dinas Lingkungan Hidup/DLH) of Surakarta City to obtain an overview of the real conditions of waste management in the field. According to Kartika (2020), the empathy stage is important because designers must understand the social and psychological conditions of users so that the solutions produced are truly relevant to their needs. In this context, the community demonstrated a need for educational media that is engaging and easy to understand regarding the 3R concept.

b. Define

Table 1. Level of Awareness and Perceptions of 3R-Based Waste Management

No	Level of Awareness and Perceptions of 3R-Based Waste Management	Percentage	Respondents
1.	Waste Management, Particularly in the Surakarta Area	42,5%	28
2.	Community Awareness in Waste Management	31,8%	21
3.	Understanding of the 3R Principles (Reduce, Reuse, Recycle)	80,3%	53

4.	Frequency of Waste Sorting by Type	40,9%	27
5.	Attitudes Toward the Implementation of the 3R Principles	98,4%	65
6.	Access to and Adequacy of 3R Information	31,8%	21
7.	Interest in E-books as an Educational Medium	84,9%	56
8.	Respondents' Perceptions of Media Effectiveness	92,4%	61
9.	Impact of Engaging Visuals on Understanding and Awareness	72,7%	48

(Source: Galih Indra Permana, 2025)

The define stage is the process of formulating the core problem based on the results of observations and interviews. The data collection results indicate that the main issues lie in low environmental literacy and the lack of educational visual media that can explain the 3R concept in an engaging manner. According to Plattner, Meinel, and Leifer (2011), this stage is important for narrowing the problem scope so that the designed solutions become more focused and directed. In this context, the e-book design is directed toward presenting educational content based on interactive visuals that are easily accessible to the wider community.

c. Ideate

Figure 2. Referensi Moodboard
(Source: Pinterest)

At this stage, various creative ideas are developed to find the best solutions to the defined problems. This process involves brainstorming and creating moodboards to determine the visual style, illustrations, and layout of the e-book. The ideate stage is a moment of free exploration to generate as many ideas as possible without limitations, before ultimately selecting the ideas that best suit the user context and design objectives (Kelley & Kelley, 2013).

d. *Prototype*

Figure 2. Referensi Moodboard
(Source: Pinterest)

The prototype stage is the implementation of ideas into a tangible form in the form of an initial visual design of the e-book. This prototype includes page layouts, educational illustrations explaining the processes of Reduce, Reuse, and Recycle, as well as the selection of color palettes and typography that align with the characteristics of educational media. According to Stickdorn and Schneider (2012), creating prototypes helps designers visualize ideas and conduct early testing before full implementation, thereby minimizing design errors at the final stage.

e. Test

Table 2. Results of the 3R E-book Beta Test

No.	Statement	Strongly Agree	Agree	Slightly Disagree	Disagree	Strongly Disagree
1	I understand the concepts of Reduce, Reuse, and Recycle after reading this e-book.	21	7	1	0	0
2	The material presented in this e-book is easy to understand.	19	10	0	0	0
3	The information in this e-book increases my knowledge about waste management.	16	13	0	0	0
4	The examples provided are relevant to everyday life..	20	8	1	0	0
5	Illustrations and visual elements help me understand the content.	19	9	1	0	0
6	The e-book design (colors, typography, and layout) looks attractive..	19	9	1	0	0
7	The language used is clear and not confusing	15	13	1	0	0
8	This e-book encourages me to apply the 3R principles in daily life.	15	13	1	0	0

9	The content of the e-book matches current informational needs regarding waste management.	16	13	0	0	0
10	Overall, this 3R e-book is suitable for use as an environmental education medium..	16	13	0	0	0

(Source: Galih Indra Permana, 2025)

The final stage of this design process is the testing of the 3R e-book design. The testing begins with a beta test conducted with the target users to determine the effectiveness of the e-book in increasing understanding and awareness of the Reduce, Reuse, and Recycle (3R) principles. The beta test is carried out by evaluating user responses to the content and visual presentation of the e-book.

Based on the beta test results, most respondents assessed that overall the 3R e-book is suitable for use as an environmental education medium. Subsequently, the e-book is submitted to expert reviewers to assess the feasibility of the content, visual presentation, and alignment with the design objectives. Feedback from the reviewers is used as the basis for final refinement through an evaluation and revision process. After completion, the 3R e-book is then uploaded and disseminated through the official social media platforms of the Environmental Agency (Dinas Lingkungan Hidup) of Surakarta City.

RESULT AND DISCUSSION

The design of the 3R (Reduce, Reuse, Recycle) e-book as an educational medium is intended for the community, particularly in Surakarta City and its surrounding areas, with a target audience of young people aged 17–30 years. This design aims to increase awareness of the importance of sustainable waste management. Through this e-book, information related to the 3R concept, its application in daily life, and its environmental impacts is presented in an effective, informative, and engaging manner, making it easy to understand while encouraging positive changes in attitudes and behaviors toward greater environmental responsibility. In addition, the e-book design is supported by the development of strategically designed supporting media to strengthen the message, clarify the material, and enhance public understanding of the importance of responsible and sustainable waste management.

Data collection for the design of the 3R e-book was carried out through interviews with informants from the Environmental Agency (Dinas Lingkungan Hidup) of Surakarta City, observations of environmental conditions in and around Surakarta City, and the distribution of questionnaires to 66 young respondents. Furthermore, a literature study was conducted to obtain more accurate and relevant information as supporting research data, ensuring that the compiled materials have a strong foundation and are aligned with real conditions in the field.

The creative process began with the compilation of a moodboard as a reference for the visual concept, followed by the determination of the e-book content. This was then continued with the initial sketching stage, involving a design that combines illustrations, typography, layout, and the use of several supporting photographs. To ensure the feasibility and effectiveness of the medium, the e-book was subsequently tested through a beta test involving the target readers before finally being disseminated through official media channels.

Figure 3. Examples of Several Pages of the 3R E-book
(Source: Galih Indra Permana, 2025)

The results of the 3R (Reduce, Reuse, and Recycle) e-book design apply a simple and minimalist illustration style that is tailored to the characteristics and preferences of the younger generation. The selection of bright and harmonious color combinations aims to enhance visual appeal and maintain readers' interest so they do not easily feel bored. In addition, the application of a neat, flexible, and well-structured layout is designed to help readers easily understand and follow the flow of information in a systematic and effective manner.

The beta test results of the 3R e-book indicate positive responses from most respondents. Based on the questionnaire data, the majority of respondents stated that they understood the concepts of Reduce, Reuse, and Recycle after reading the e-book. Furthermore, the illustrations and visual elements were considered helpful in clarifying and facilitating the understanding of the presented material. From a visual perspective, respondents assessed that the e-book design including color selection, typography, and layout appears attractive and comfortable to read. Beyond improving understanding, the 3R e-book was also perceived to have a persuasive impact, with most respondents feeling encouraged to apply the 3R principles in their daily lives. These results indicate that the 3R e-book is suitable for use as an effective environmental education medium.

CONCLUSION

The 3R (Reduce, Reuse, and Recycle) e-book as an educational medium is designed to increase public awareness particularly among young people aged 17–30 years in Surakarta City and its surrounding areas of the importance of sustainable waste management. In the design process, visual concepts and strategies are developed by considering the characteristics, needs, and habits of the younger generation as the target audience. Research stages and data analysis are conducted beforehand to ensure that the messages delivered through the e-book are received effectively, remain relevant, and are able to generate positive impacts for readers, the environment, and society at large.

Providing education on the 3R principles through the e-book medium has proven effective in increasing audience understanding and interest in waste management issues. This is demonstrated by the beta test results, which show that the target readers are able to understand the concepts of Reduce, Reuse, and Recycle, and appreciate the visual design of the e-book, which is considered attractive, informative, and easy to follow. In addition, the evaluation results indicate a positive shift in readers' attitudes, encouraging them to begin applying the 3R principles in their daily lives, such as reducing the use of single-use products, reusing items that are still usable, and sorting waste before disposal.

The younger generation, as a productive age group, plays a strategic role in sustainable waste management efforts because of its potential to become agents of change within society. Therefore, providing education on 3R through an e-book that emphasizes engaging visuals, a well-organized layout, and communicative

information delivery is considered effective in increasing awareness and shaping environmentally friendly behavior. With the presence of this 3R e-book, it is expected that young people will become more actively involved in preserving environmental sustainability and supporting long-term waste reduction efforts.

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