

# DESIGNING AN INTERACTIVE AND ENGAGING BOARD GAME WITH 3R (REDUCE, REUSE, RECYCLE) THEME: A DESIGN-BASED RESEARCH

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**Abstract:** Reduce, reuse, and recycle to save the environment. Reducing means reducing trash. Reusing means looking for new uses for trashed items. Recycling means transform waste into something useful. The 3R practises bring many benefits to the environment. Unfortunately, there are many obstacles in adopting this approach in daily life, such as the lack of awareness and uncertainty about how to put it into practise. To address these issues, board games can be used as an effective educational tool, with players learning how to reuse, reduce, and recycle through game. This study employs an exploratory design with a design-based approach that combines research and design in an iterative process to develop and refine a product or solution. The study presents a 3R-themed board game with a city and marine life theme that incorporates activity cards to teach children and families about the application of 3R in daily life, such as reducing the use of certain items, reusing goods, and increasing awareness of re-made items that can be used and useful in everyday life. The findings demonstrate that the 3R-themed board game can be a highly effective tool for educating and promoting sustainable waste management practices in a fun and engaging manner, particularly for children and families.

**Keywords:** reduce, reuse, recycle, board game, educative games

## INTRODUCTION

The urgent need for sustainable practices and environmental awareness has led to increased interest in promoting the principles of reduce, reuse, and recycle (3R) in various aspects of daily life. One promising avenue for promoting environmental consciousness and educating individuals about sustainable practices is through interactive and engaging board games (Kennedy, Tipps and Johnson, 2008). These games have the potential to create a fun and immersive learning experience that fosters understanding and active participation in environmental conservation efforts.

This paper aims to present the design and development process of an interactive board game with a 3R theme, focusing on the principles of reduce, reuse, and recycle. By employing a design-based research methodology, we aim to create a game that not only entertains but also educates players about the importance of sustainable practices and their role in protecting the environment.

The board game will be designed to engage players of different age groups and provide them with opportunities to make decisions and solve challenges related to waste management, resource conservation, and sustainable consumption. Through gameplay, players will learn about the environmental impact of their choices and develop strategies to achieve sustainable outcomes.

To ensure the effectiveness and educational value of the game, extensive research will be conducted during the design process. This research will involve gathering insights from

books about the reduce, reuse and recycle. Additionally, user testing and feedback will be incorporated to refine the game mechanics, rules, and educational content.

### **Reduce, Reuse and Recycle**

In the book "Reduce, Reuse, Reimagine: Sorting Out the Recycling System" (2018), Beth Porter emphasizes the crucial first step in waste reduction, which is reducing our consumption. The well-known phrase "reduce, reuse, recycle" carries more weight than a mere slogan; it represents a hierarchical approach that aims to enhance sustainability. Reuse involves utilizing waste items that can still serve their original purpose or be repurposed for other uses. Reduce entails eliminating items that contribute to waste generation. Recycling involves the process of converting waste into new and useful products or materials. Figure 1 illustrates the complete waste management hierarchy, which categorizes disposal options based on their environmental benefits. At the top of the hierarchy, source reduction takes precedence as the primary focus. On the other hand, landfills and incineration, situated at the bottom of the hierarchy, should be avoided due to their lack of environmental advantages.

Learning through board games has been recognized as an effective educational tool, offering several benefits for learners. Research studies have demonstrated the effectiveness of board games in enhancing various cognitive, social, and emotional skills. Board games provide an interactive and engaging learning environment that promotes active participation and problem-solving. According to a study conducted by (Battistich, Schaps and Wilson, 2004) interactive learning experiences, such as those offered by board games, stimulate critical thinking skills, enhance decision-making abilities, and foster strategic planning.

Moreover, board games facilitate experiential learning, allowing players to apply theoretical knowledge into practical scenarios. This hands-on approach promotes deeper understanding and retention of concepts. A study by (Suren and Ali Kandemir, 2020) Ma, Nickerson, and Chuk (2018) found that students who learned through board games showed higher levels of comprehension and long-term retention compared to those using traditional instructional methods.

Board games also promote social interaction and collaboration among players. Through cooperative gameplay and communication, players develop teamwork, negotiation, and conflict resolution skills. A study by (Tsai et al., 2021) indicated that using a board game to teach about sustainable development is an effective teaching strategy that employs board games for Education for Sustainable Development (ESD). The use of board games for ESD offers a unique and engaging way to teach sustainable development concepts. Moreover, board games encourage social engagement, empathy, and the development of interpersonal relationships.

### **METHODS**

This study utilizes a qualitative research approach and employs the research through design methodology. Research through design is a scholarly approach that utilizes design methods, practices, and processes (Zimmerman and Forlizzi, 2014; Stappers and Giaccardi, 2018). To translate knowledge and insights into tangible outcomes through practical design work. By adopting the research through design approach, this study aims to bridge the gap between theory and practice, resulting in practical and tangible outcomes that enhance the learning experience of sustainable development through a game board. The design process serves as a platform to materialize knowledge and insights, fostering a deeper understanding and appreciation of sustainable activities in everyday life.

In the diagram below, the research through design process are explained.

## FINDINGS AND DISCUSSION

The outcomes are explained based on the flowchart outlined in the research methodology. By examining twelve existing educational board games centered on sustainable development, it was discovered that these games have the potential to simplify intricate sustainable development issues by presenting real-world applications of sustainable development principles that resonate with players. Most of the educational board games emphasize and promote collaboration and teamwork among players. Cooperative games, in particular, cultivate communication, negotiation, and social skills as players collaborate towards achieving a shared objective. By encouraging social interaction, these games facilitate the development of interpersonal skills and promote effective teamwork. However, it was observed that these games often lack sufficient opportunities for players to actively engage with real-world challenges and implement sustainable solutions. Additionally, a notable drawback is the absence of feedback and reflection within these educational board games. To create effective learning experiences, it is imperative for educational board games on sustainable development to integrate mechanisms that provide feedback on players' decisions and actions, while also encouraging reflection on the consequences of their choices.



**Figure 1. twelve existing educational board games**

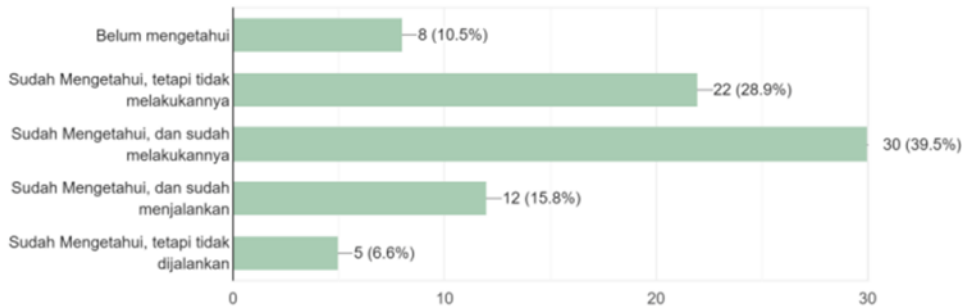
Based on interviews conducted with three game master boards, psychologists, and experts in sustainable development, it was discovered that there is currently no board game available that specifically addresses the theme of environmental friendliness and the 3R principles (Reuse, Reduce, Recycle). The age group most aware of the waste problem is individuals between the ages of 22 and 40. However, real-life activities related to practicing the 3R principles are quite limited. The most common practice among this age group is reducing the use of plastic in their daily lives by bringing their own water bottles and using paper bags.

Based on the questionnaire conducted among 76 families residing in Jakarta and Tangerang, several key findings have emerged:

- a. Traditional games like Monopoly (77.6%) and Snakes and Ladders (76.3%) remain highly popular among families.
- b. 10.5% of the respondents surveyed expressed unawareness of the 3R concept, while 35.5% were aware of it but did not actively practice it.
- c. Among the respondents, 18.4% admitted to not reducing their usage, while the same percentage acknowledged not engaging in reuse.
- d. A significant majority of respondents (63.2%) have not yet embraced recycling practices.
- e. A striking 84.5% of the respondents revealed a tendency to be lazy and forgetful when it comes to implementing the 3R principles. This behaviour stems from a perceived lack of urgency, insufficient knowledge, and a failure to seek out relevant information.

**Seberapa familiar keluarga dengan 3R?**

76 responses

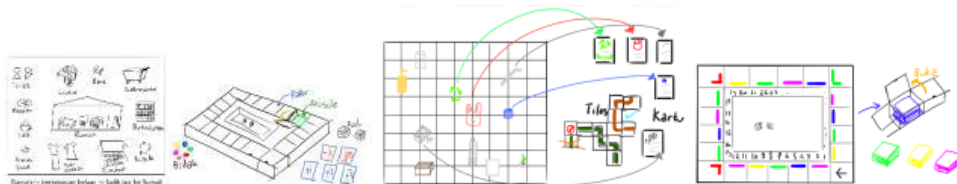


**Figure 2. Results of questionnaires on the application of the 3R movement in everyday life**

Based on the observations, interviews, and questionnaire, it can be concluded that the application of the 3R movement in everyday life can be concluded into three groups:

- Most respondents have already developed habits that are not aligned with sustainable practices and are resistant to changing their lifestyles.
- There is a group of respondents who are aware of environmental issues and show concern, but they lack the motivation or willingness to implement changes in their daily lives.
- Another significant finding is that many respondents lack the necessary knowledge and guidance on how to effectively apply the principles of reduce, reuse, and recycle in their daily routines.

The next step is design process, exploring the theme 3R: reduce, reuse, recycle waste at home



**Figure 3. step is design process, exploring the theme 3R: reduce, reuse, recycle waste at home**

These observations highlight the need for educational interventions and practical solutions to address these challenges and promote the adoption of sustainable practices.

The learning content of the game is to teach players how to reduce, reuse, recycle the common waste at home like paper, plastic bag, cup, bottle. To provide challenge there will be 3 levels: beginner, normal and hard. The name of the game is Dampak, it is an acronym taken by merging two Indonesian word "Dampak" and "Sampah".



**Figure 4. Material "Sampah Anorganik"**



**Figure 5. The Game**

The game consists of three main components: a game board, 70 cards, and 4 token pieces. The cards are divided into three categories: 30 green cards for reduce activities, 20 blue cards for reuse activities, and 10 yellow cards for recycle activities, and 10 red cards for assignment card in which players are asked to do 3R activities.

Rules of the game:

1. Shuffle all 70 cards.
2. Select 3 players, with 1 player designated as the judge who determines whether the player's answer is correct or not.
3. Each player is dealt 5 cards at the beginning, which can be a mix of reduce, reuse, and recycle cards
4. The challenge is to come up with creative solutions for the action described on each card. For example, if a reduce card depicts a plastic bag, the player needs to suggest innovative ways to reduce plastic bag usage.
5. The player with the most cards at the end of the game is the loser.
6. As the game progresses, the used cards are collected and sorted based on the type of waste, helping players learn how to separate waste at home.

By playing this game, players not only have fun but also gain knowledge and awareness about sustainable practices and waste management.



**Figure 6. The game is tested with 10 different people with the age range from 8 – 45 years old.**

Based on user reviews using a scale of 1 to 5, where 1 represents unsatisfied and 5 represents satisfied, the game received an impressive score of 4.75 in terms of its educational value. This indicates that players found the game highly informative and effective in teaching them about the concepts of reduce, reuse, and recycle. The game successfully conveyed important lessons on waste management, encouraging players to think critically about their actions and the impact on the environment.

In terms of enjoyment, the game received a score of 3.71. While this score suggests that players found the game enjoyable, there is room for further improvement to enhance the entertainment factor. Incorporating more engaging gameplay mechanics, exciting challenges, and immersive storytelling could potentially boost the enjoyment level for players, making the gaming experience more captivating and memorable.

Regarding the ease of playing, the game received a score of 3.51. This suggests that while players were able to understand and play the game, there were some areas that could be refined to make the rules and mechanics more intuitive and user-friendly. Streamlining the instructions, providing clearer guidelines, and simplifying complex concepts could enhance the ease of playing, making the game more accessible to a wider range of players.

Overall, the user reviews indicate that the game is highly regarded in terms of its educational value, with room for improvement in the areas of enjoyment and ease of playing. Taking into account the feedback and suggestions provided by users, future iterations of the game could focus on enhancing the gameplay experience, ensuring that players not only gain valuable knowledge about waste management but also thoroughly enjoy the gaming experience.

## CONCLUSIONS

In conclusion, this research study focused on the design and development of an interactive and engaging board game with a 3R (Reduce, Reuse, Recycle) theme, employing a design-based research approach. The primary objective was to create a game board that effectively teaches users how to apply the principles of 3R to manage waste at home and highlights the importance of waste separation and its environmental impact.

The findings of this study highlight the effectiveness of the board game in promoting knowledge and understanding of 3R practices among players. Through the engaging and interactive gameplay, users were able to learn and apply strategies to reduce, reuse, and recycle their waste effectively. The game board design successfully incorporated elements that facilitated waste separation, educating players on proper waste management techniques and emphasizing the significance of their actions in mitigating environmental harm.

The developed board game serves as a valuable educational tool for individuals of various age groups, households, and educational institutions, offering a practical and enjoyable way to learn about waste management and the impact of waste on the environment. It provides users with hands-on experience and practical knowledge that can be translated into real-life actions and contribute to more sustainable practices.

Further research and evaluation are recommended to assess the long-term effectiveness and impact of the board game on players' waste management behaviors and environmental consciousness. Additionally, exploring the potential for digital adaptations or wider dissemination of the game could extend its reach and impact on a larger audience.

In conclusion, the interactive and engaging board game designed in this research study offers a promising solution for promoting 3R practices, waste separation, and environmental awareness. By combining education with entertainment, it has the potential to inspire positive behavior change and contribute to a more sustainable future.

We would like to extend our appreciation to Dr. Martin L. Katoppo S.T.M.T., the Dean of the Faculty of Design, and Dr.-Ing. Ihan Martoyo, S.T., M.Sc., the Chairman of the Center for Research and Community Development (CRD), for their invaluable support throughout this research project. This article represents a part of a series of research publications conducted under the registration number PM-076/SOD/III/2019 at the Center for Research and Community Development (CRD) of Pelita Harapan University.

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