

CHAPTER 1 INTRODUCTION

1.1 Background

The rapidly expanding population of Indonesia has significantly contributed to the escalating volume of household waste. According to the Ministry of Environment and Forestry (KLHK), Indonesia churns out 21 million tons of trash annually, of which only about 65.71% (13.9 million tons) is appropriately managed. The remaining 34.29% (7.2 million tons) is haphazardly disposed of, leading to environmental pollution in rivers, seas, and soil. These waste-related issues are not just a concern but a pressing problem for many Indonesians. The World Health Organization (WHO) warns that daily human activities generating waste further worsen the situation. Coupled with a lack of concern for environmental cleanliness, this has led to a dire state of environmental pollution¹.

Environmental issues have become a serious concern. The scattered piles of waste around us are a direct consequence of human behavior. Regardless of their level of education or social status, people still frequently dispose of waste irresponsibly. Such behavior reflects a lack of responsibility and can lead to environmental destruction². Therefore, we must take responsibility for our actions toward the environment.

Islam itself has emphasized the importance of preserving the Earth, as mentioned in the Qur'an in Surah Al-A'raf: 56:

وَلَا تُفْسِدُوا فِي الْأَرْضِ بَعْدَ إِصْلَاحِهَا وَادْعُوهُ خَوْفًا وَطَمَعًا إِنَّ رَحْمَتَ اللَّهِ قَرِيبٌ
مِّنَ الْمُحْسِنِينَ

The Quranic verse, which emphasizes the importance of not causing corruption on the earth, resonates with today's environmental issues. It calls for

¹ Mochammad Chaerul And Sharfina Ulfa Zatadini, 'Perilaku Membuang Sampah Makanan Dan Pengelolaan Sampah Makanan Di Berbagai Negara: Review', *Jurnal Ilmu Lingkungan* 18, No. 3 (1 December 2020): 455–66, <https://doi.org/10.14710/Jil.18.3.455-466>.

² Jeni J Therik, 'Perilaku Masyarakat Dalam Penanganan Sampah Di Kelurahan Naikolan Kota Kupang' 16, No. 2 (2021).

responsible actions and stewardship of the environment, aligning with the message of this research³.

Human actions driven by personal gain without consideration of interests can accelerate the destruction and depletion of natural resources. Consequently, environmental damage and losses become unavoidable. In addition, public awareness of waste management remains low. Many people fail to sort their waste correctly, ignore regulations, and carelessly dispose of garbage⁴. Such behavior should be corrected from an early age to foster positive habits and shift skeptical attitudes toward the importance of waste management. An effective way to address this issue is by educating children about the importance of waste management and environmental protection from a young age⁵.

Early childhood is a golden period during which development and growth occur rapidly. At this stage, children are not yet fully able to distinguish right from wrong, making them easily influenced by their surroundings and naturally inclined to absorb several kinds of information. Children are highly sensitive, which is reflected in their intense curiosity and tendency to ask many questions⁶. Early childhood education is essential in achieving optimal development and optimizing children's development according to their growth stages. This training includes the learning process for children aged 0-6 years, both in formal and informal settings. One of the most popular forms of informal learning among children today is games⁷.

A game is a form of play typically used for entertainment or leisure. However, games can also serve as a learning medium, known as educational games.

³ Sasmitha Tabah Begyani, 'Program Studi Pendidikan Agama Islam Fakultas Tarbiyah Dan Ilmu Keguruan Universitas Islam Negeri Prof. K. H. Saifuddin Zuhri Purwokerto', N.D.

⁴ Desi Natalia Marpaung, Yudha Nur Iriyanti, And Diansanto Prayoga, 'Analisis Faktor Penyebab Perilaku Buang Sampah Sembarangan Pada Masyarakat Desa Kluncing, Banyuwangi', *Preventif: Jurnal Kesehatan Masyarakat* 13, No. 1 (29 March 2022): 47–57, <https://doi.org/10.22487/Preventif.V13i1.240>.

⁵ Ardian Pramudya Alphita And Pratyaksa Ocsa Nugraha Saian, 'Pengembangan Aplikasi Edukasi Pengelolaan Sampah Untuk Anak Sekolah Dasar Berbasis *Mobile* Dengan Teknologi Machine Learning', *It-Explore: Jurnal Penerapan Teknologi Informasi Dan Komunikasi* 2, No. 1 (4 February 2023): 1–17, <https://doi.org/10.24246/Itexplore.V2i1.2023.Pp1-17>.

⁶ Rahma Hidayati, 'Peran Orang Tua : Komunikasi Tatap Muka Dalam Mengawal Dampak Gadget Pada Masa Golden Age', *Source: Jurnal Ilmu Komunikasi* 5, No. 2 (18 February 2020), <https://doi.org/10.35308/Source.V5i2.1396>.

⁷ Irfhamna Irfhamna And Sigit Purnama, 'Peran Lingkungan Sekolah Dalam Pembentukan Karakter Anak Usia Dini Di Paud Nurul Ikhlash', *Jurnal Pendidikan Anak* 11, No. 1 (27 May 2022): 68–77, <https://doi.org/10.21831/Jpa.V11i1.46688>.

Educational games stimulate thinking skills, enhance concentration, and help users solve problems. As a learning tool, educational games provide an engaging opportunity to expand knowledge through an interactive approach⁸. Games are closely related to multimedia elements, as they integrate components, such as text, sound, images, animation, audio, and video, to create a comprehensive experience. In the context of environmental education, educational games can be designed to teach children about different types of waste and how to sort and manage them properly. Through interactive simulations, children can more easily understand the concept of waste sorting and its impact on the environment. Waste is categorized into three main types: organic, non-organic, hazardous, and toxic (B3). Organic waste refers to waste that can naturally decompose with the help of microorganisms, such as food scraps, dry leaves, and tree branches, which can be recycled into compost. Non-organic waste consists of materials that do not decompose quickly, such as plastic, metal, glass, and paper. These materials require recycling processes to be reused and to prevent environmental pollution. Hazardous and toxic waste (B3) includes waste that poses a risk to humans and the environment, such as used batteries, pesticides, electronic waste, and medical waste. This type of waste must be managed using special procedures to prevent ecosystem harm. This educational game aims to engage the younger generation in addressing the issue of waste by fostering a more profound understanding, enabling each individual to actively participate in efforts to reduce waste accumulation, both now and in the future⁹. Several studies have shown that the Multimedia Development Life Cycle (MDLC) can enhance the quality of multimedia applications.

A previous study that utilized the MDLC method, titled "Efforts to Improve Self-Image Through a Mobile-Based Educational Game on Personality Development," demonstrated the effectiveness of this approach. Testing with the Black-Box method revealed a content suitability rate of 87.7%, indicating that the system was successful and suitable for supporting teaching and learning

⁸ Rina Nuqisari And Endah Sudarmilah, 'Pembuatan *Game* Edukasi Tata Surya Dengan Construct 2 Berbasis Android', *Emitor: Jurnal Teknik Elektro* 19, No. 2 (10 September 2019): 86–92, <https://doi.org/10.23917/Emitor.V19i2.7987>.

⁹ Devi Gustiani And Iedam Fardian Anshori, 'Perancangan *Game* Edukasi Pengenalan Sampah Organik Dan Non-organik Di Lingkungan Tkit Bustanul'Ulum' 2, No. 2 (2021).

activities¹⁰. Another study applied the System Development Life Cycle (SDLC) approach and the waterfall model to develop an educational game. Usability testing resulted in an overall average score of 66.25. Thirteen respondents gave a System Usability Scale (SUS) score between 61 and 80, indicating that the game effectively supported student learning. Some respondents expressed their enjoyment of the game and intention to play it repeatedly¹¹. Furthermore, another study that applied the SDLC method using the fountain model found that testing with the Likert scale yielded a score of 86.74, falling into the strongly agree category. However, this system still required maintenance and improvements to fix potential bugs and add additional features¹². In this research, the game is developed in a mobile format because mobile devices are more accessible to several groups, especially students, without requiring additional hardware such as computers or consoles. With a mobile-based platform, the game can be played anytime and anywhere, increasing learning effectiveness. Additionally, the widespread use of mobile devices facilitates adoption without needing specialized equipment. The MDLC (Multimedia Development Life Cycle) method was chosen because it is designed to develop multimedia-based applications, including educational games. MDLC follows a systematic process consisting of Concept, Design, Material Collecting, Assembly, Testing, and Distribution, making it highly suitable for ensuring a structured development of this game. Additionally, this method provides flexibility in development and testing, allowing for more effective evaluation and improvement to enhance the game's quality.

This research was conducted at Muhammadiyah Bruno Elementary School in Purworejo, which was chosen as the research site. This location was selected based on several factors, including the need for more effective interactive learning methods and low student awareness regarding waste segregation. Using the school environment as a case study, this educational game can be directly implemented for young children still in the habit-forming stage.

¹⁰ Hazacky Azwat Ramadhan, Renny Puspita Sari, And Dian Prawira, 'Rancang Bangun Aplikasi Sampah Market Menggunakan Model Fountain', No. 1 (2021).

¹¹ Nuqisari And Sudarmilah, 'Pembuatan *Game* Edukasi Tata Surya Dengan Construct 2 Berbasis Android'.

¹² Ramadhan, Sari, And Prawira, 'Rancang Bangun Aplikasi Sampah Market Menggunakan Model Fountain'.

Therefore, the author conducted an initial observation by distributing research questionnaires to measure Muhammadiyah Bruno Elementary School students' knowledge about different types of waste and the level of waste segregation implementation at school and home.

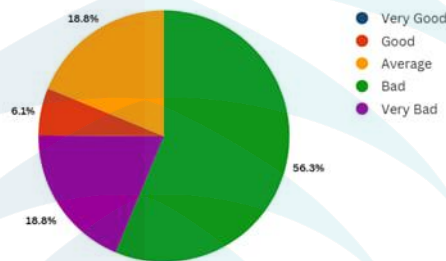


Figure 0.1 Research Questionnaire on Understanding Types of Waste

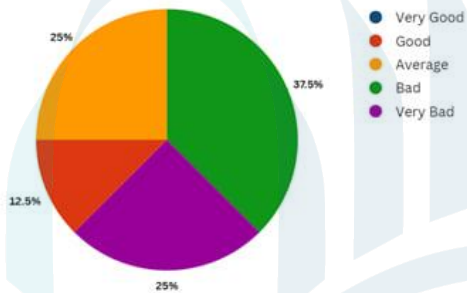


Figure 0.2 Research Questionnaire on Waste Sorting

Based on the analysis of the questionnaire results presented in Figure 1.1, 56.3% of students (15 out of 28) still struggle to understand the different types of waste, including distinguishing between organic, non-organic, hazardous, and toxic waste (B3). Additionally, the data in Figure 1.2 shows that 37.5% of students (10 out of 28) have not yet correctly implemented waste segregation at school or home. These findings indicate that students' understanding and awareness of the importance of waste management are still relatively low.

As a solution, the author developed a mobile-based educational waste-sorting game using Construct 2. This game is designed to help students better understand different types of waste and how to sort them while encouraging behavioral changes so they can apply proper waste segregation at home and school.

1.2 Problem Formulation

The problem formulation derived by the author from the background explanation is as follows:

1. The limited availability of practical learning methods regarding different types of waste.
2. Students lack waste sorting implementation in school and home environments.

1.3 Objectives

The objectives of this study are as follows:

1. To introduce an educational game application for waste sorting to enhance children's understanding of waste and environmental conservation.
2. To design a 2D-based educational game using Construct 2 to help teach children about waste sorting.

1.4 Benefits

The author hopes that this research will provide the following benefits:

1. Benefits for Researchers

This research opens opportunities for further studies on the effectiveness of game-based approaches in environmental education, particularly in waste sorting.

2. Benefits for the University

It provides insights into students' ability to master the learning content acquired during their academic studies.

3. Benefits for Society

It makes waste sorting knowledge easier to learn and understand, reducing environmental pollution.

1.5 Problem Boundaries

To ensure the research remains focused, the following problem boundaries are established:

1. The educational game for introducing waste sorting will focus on three main types: organic waste, non-organic waste, and hazardous and toxic waste (B3).
2. The educational game is designed for children aged 5-10, with content tailored to their cognitive abilities.
3. The primary features being developed include gameplay for waste sorting and a point collection mechanism.
4. Feasibility testing will be conducted using the Black-Box method and involve a limited number of respondents as test samples.
5. The educational content in the game includes basic instructions on waste types and proper sorting but does not provide detailed information on recycling processes or advanced waste management.
6. The application is developed using Construct 2 r288 for game creation.

1.6 Systematics of Discussion

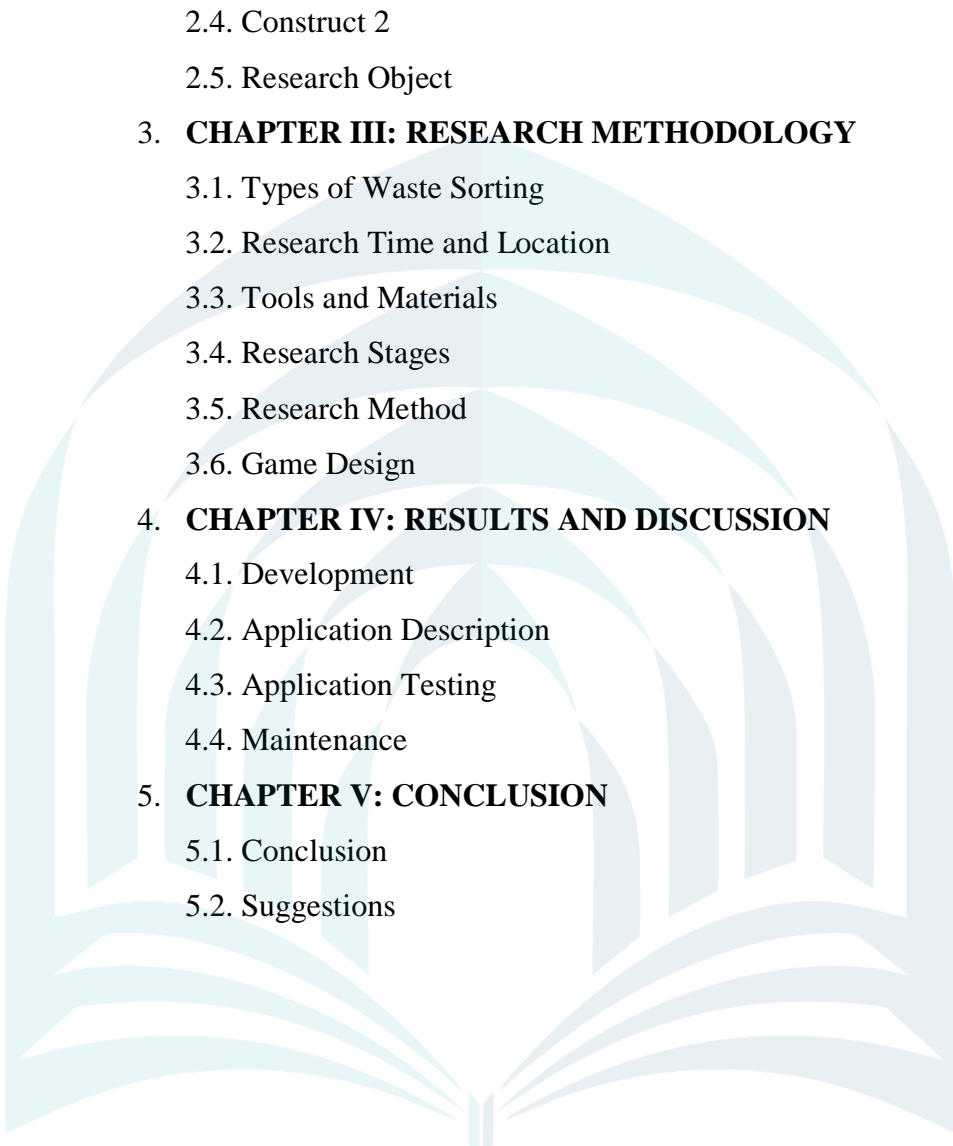
This section explains the Thesis structure, which consists of chapters from the Introduction to the Conclusion, along with a summary of each chapter. The explanation is aimed at helping the reader understand the flow of the discussion presented in this Thesis.

1. INTRODUCTION

- 1.1. Background
- 1.2. Problem Formulation
- 1.3. Objectives
- 1.4. Benefits
- 1.5. Scope of Study
- 1.6. Systematic Discussion

2. CHAPTER II: LITERATURE REVIEW

- 2.1. Previous Research
- 2.2. Theoretical Review
- 2.3. Educational Games

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- 2.4. Construct 2
 - 2.5. Research Object
 - 3. **CHAPTER III: RESEARCH METHODOLOGY**
 - 3.1. Types of Waste Sorting
 - 3.2. Research Time and Location
 - 3.3. Tools and Materials
 - 3.4. Research Stages
 - 3.5. Research Method
 - 3.6. Game Design
 - 4. **CHAPTER IV: RESULTS AND DISCUSSION**
 - 4.1. Development
 - 4.2. Application Description
 - 4.3. Application Testing
 - 4.4. Maintenance
 - 5. **CHAPTER V: CONCLUSION**
 - 5.1. Conclusion
 - 5.2. Suggestions

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