Educational Media for Early Childhood on Waste Management to Encourage Zero Waste Living Sustainably

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Abstract. Marine pollution comes from waste and brings a solemn issue since the utmost debris in the sea comes from urban and residential household waste. The family has a critical role in reducing household waste, which can further decrease the negative impact on marine life. Meanwhile, education on waste management is still insignificant for children and their parents. It is necessary to have a source of information for children from an early age to encourage awareness to implement an environmentally conscious life. Illustrated books were chosen as learning media for young children to develop their imagination and behavior. The research focused on how to design educational illustration books for early childhood education about the marine environment and its relation to daily life in their home environment in a sustainable manner. This research used a qualitative method with Human-Centered Design (HCD) approach: inspiration, ideas, and implementation. The output is the book's design (as the prominent article), besides supporting work, including Instagram feeds, stickers, and x-banners as promotional media with syntactic visuals with the book. By fusing contemplative themes cheerfully and humorously combined with encouraging emotional connections, the lessons presented in this book could be more accepted pleasantly by children.

1 Introduction

The earth consists of 71% water and 29% land. All the water 97% comes from the oceans [1]. The disruption of marine life will affect the Earth because it affects the equilibrium of the Earth. In addition, human life is disturbed considering the sea is a vital component of life.

According to the Ministry of Environment and Maritime Affairs, the cause of marine pollution comes from waste, especially plastics that is difficult to decompose and has a high impact on the sea and humans. In addition to plastic waste being able to kill several marine species, it is also dangerous for human health because fish meat containing plastic can be eaten by humans [2]. The Coordinating Ministry for Maritime Affairs and Investment stated that the problem of plastic waste is a solemn issue for Indonesia because it is considered the second largest contributor to plastic waste in the world. For this reason, the Ministry of Maritime Affairs and Fisheries has announced that by 2025 the amount of plastic waste in the sea has to be reduced by 70 percent [3].

The government has made efforts through the Ministry of Environment and Forestry, including providing understanding to the public about the impacts that occur as a result of actions that damage the coast and sea, supporting and funding the movement to remove trash from the sea, promoting mangrove planting programs around coastal areas, repairing environmental damage, and so on. However, it is not enough to solve the problem of marine debris only downstream through cleaning the beach, but also upstream by educating schools as well as cultural approaches through activities in the community, hoping it will control the waste in the sea. For this reason, it is necessary to raise awareness among people that have contributed a lot to pollution and environmental damage. Public awareness is needed to reduce the amount and process of household waste, which can further reduce the negative impact on marine life [2].

Garbage, according to Wardhani, is the result of the residual process of human consumption. As long as waste has not gone through the consumption process, it cannot be called garbage [4]. According to the Law of the Republic of Indonesia Number 18 of 2008 concerning Waste Management, waste is the residue of daily human activities and/or natural processes in solid form [5]. Meanwhile, according to the World Health Organization, waste is goods originating from human activities that can no longer be used, used, liked, or just something that is thrown away [6]. Wardhani said that the waste management system for the housing scale is self-management, in which the community manages their own waste by sorting it from the household and composting organic waste [4]. From the explanation above, all goods produced by humans will potentially become waste after being consumed. Hence, people have to reduce the amount of production and consumption of goods that have the potential to become waste. For this reason, the family has a critical role since the utmost waste in the sea comes from household waste.

Based on the conditions above, the identification of the problem found: an increase in marine debris by 10%
every year; waste scattered in the sea comes from urban and residential waste is not processed; education on waste management is insignificant both for children and their parents; the practice of living with awareness of the environment starting from habits at home has proven to be effective in reducing the amount of waste. Regarding the need of practicing waste-free lifestyles, according to Carolin, it is essential to comprehend and analyze information, as the decision to use the trash or not will have a significant impact [7]. Therefore, it is necessary to have a source of information for children from an early age, which is packaged in a medium to encourage awareness to implement an environmentally conscious life. It is a medium for parents to convey information in the family environment, in the form of knowledge about waste and its management, to support efforts to introduce and educate family members to be aware of a sustainable environment. The sea is the topic, considering that many household wastes are found and affect the sea, which includes the lives of creatures in it. The sea is also a fascinating ecosystem for children to learn, as well as it is a critical element in human life.

Illustrated books are the medium chosen as learning media because they are suitable for young children to develop their imagination and behavior. In line with the opinion of Bossert's assertion that books can help social skills and imaginative growth in early childhood [8]. Walker said that message content is conveyed through illustrations because it is impressive and fun for early childhood [8]. Evelyn Ghozalli said that illustrations are all types and forms of work produced, poured, or created by illustrators with techniques, both manually or digitally, mixed media, with the addition of innovative approaches nowadays" [9]. Kartaatmadja explained that illustration plays an essential role in the flourishing of children's sensitivity to visuals, which has even become the basis of sensitivity before children can speak [10]. In addition, Klanten & Hellige said that books with good context on target and pleasing illustrations can also influence early childhood cognitive intelligence in digesting messages [8].

The research focused on how to design educational illustration books for young children about the marine environment and its relation to daily life in the home environment in a sustainable manner. Researchers hope that this illustrated book can disseminate information and inspire children to act as a means to introduce an environmentally friendly way of life that starts from inside the house and understands the problem of waste and its relationship with the marine ecosystem, according to the age and development of the child. The research target is children aged 5 to 8 years with the consideration that at this age, according to Charlotte Buhler, children aged 5 to 8 years are in a period of child socialization, where children begin to enter the wider community (called kindergarten), begin to experience association with playmates, have an objective appreciation, so that they began to learn the meaning of work achievements and duties [11]. According to Hackel, the psychological development of children up to the age of 8 is the 'hunting' period when children enjoy catching various animals and insects, have hunting imaginations such as playing with arrows, and slingshots, sneaking and hunting around their friends [11]. According to Ghozalli, this age group falls into the Pre-Reading Level 2 category, equivalent to advanced in Early Childhood Education Programs (PAUD). This level is the level to develop social skills and simple thinking with guidance. Topics of stories that interest them are about various animals, plants, and objects around them, self-concept (humans), introduction to basic literacy (characters and numbers 1-20), and fables (animal tales), as well as fundamental moral knowledge. The proportion of the illustration is 90%, and the text is starting to appear but with a quite large sans serif fonts. Books generally have 8-16 pages [9].

The researchers found that similar books that are widely available on the market so far tell stories from a garbage point of view, so they are not very relevant to the children's daily life as target readers. This research will present the process of making a children's storybook which will tell a story about a child character who loves the sea very much and his worries about the condition of the marine environment that is already full of garbage, disturbing nature's sustainability. The story is told simply, presented with illustrations on each page, and equipped with an interactive page at the end of the story. Considerably a book as an educational medium about the knowledge of managing waste at home is conveyed practically in a fun way through illustrated book so it will be easily digested and understood by children.

2 Research method

This research used a qualitative method with a Human-Centered Design (HCD) approach initiated by Ideo. Ideo defines three stages in this (HCD) method: Inspiration; Ideas; Implementation [12], as shown at Figure 1 and 2. The Human-Centered Design method with Design Thinking helps clarify situation and problems, and encourages empathy. These factors then build ideas and lead to innovation. The Inspiration stage is the data collection stage by conducting literature studies, observations, and interviews besides target readers among experts. In the ideation stage, researchers process data into concepts that underlie the creation of works. At the implementation stage, researchers process data into ideas in works (prototypes) according to the output of this research, namely visual communication design works.

Fig. 1. HCD Method (ideo.org)
In the Implementation Stage, the visual communication design method used is Semiotic, initiated by Charles W. Morris. It is crucial for designers to conduct a syntactic-semantic-pragmatic reading of Charles Morris's semiotic triad methodically used into the work by visual communication designers [13]. This triadic translated as form-content-context, mostly used on fine art [14]. Through reading the content and context that are dialogically related, obtain an interpretation as the basis when designers produce a form. Form as ‘manifest text’ (encoding) not only displays beauty but is able to convey content precisely and close to context. The final result of the research is form (called artwork), related to the visual elements used—including lines, colors, shapes, typography, textures and others. Furthermore, it creates a graphic design work in the illustrated book with appropriate content in proper context.

3 Result and Discussion

3.1 Inspiration Stage

Inspiration was obtained through a series of processes by conducting literature studies, observing, interviewing, and distributing questionnaires. The literature study was carried out by analyzing illustrated books for children on environmental topics to review the latest journals related to the topic both online and offline. Observations were made by observing several families who have children. The researcher also interviews informants who are experts and practitioners of conscious environmental preservation, who are also mothers. In addition, researchers also conducted interviews with several authors and illustrators of children's books. Questionnaires were distributed to 120 respondents with profiles of young parents with children aged 5 to 8 years.

Human character has the potential to develop at an early age. Therefore, it is more efficient to introduce human sensibility to the world and its principles in childhood. Gilang, Sihombing, and Sari explained that some of the benefits of character recognition in children at an early age in the short term are training children so they can adapt to life outside the family. It is possible that constructive character development in maturity will not occur if the essential character is not disseminated from a young age. The long-term benefits of character education at an early age provide flourishing positive character cultivation as the foundation for character formation in adulthood [8]. Lenox explained that the fairy tale method or storytelling is a powerful medium for increasing children's understanding of a multicultural world that has diversity [15]. Sanchez et al. argue that the depiction of characters (into characters) is the strength of conveying topics in the form of fairy tales because it creates stimulation in children that can encourage imagination, humanize individuals, and increase empathy and understanding of an issue. This effort strengthens the moral and ethical values that move forward into the characters by stimulating critical and creative thinking [15].

Researchers interviewed Jessica Halim, the founder of Demibumi (a brand engaged in sustainable lifestyle businesses). She is a mother with two children aged 10 and 6 years. It discovered that plastic waste accounted for the majority of household waste collected. An effective way to change an environmentally conscious life is to start with self-improvement of lifestyle, then cultivate it into a lifestyle within the family. The practice is not instantaneous, and people should adapt to pre-existing habits. It is easier to introduce the concept of conscious living to children through praxis with unique, curious, and engaging solutions than present facts through written data as learning.

Riama Maslan Sihombing and Ratna Kusuma, two authors and illustrators of children's books, participated in the interviews. According to Riama, a lecturer in Visual Communication Design, children do not like educational content that is patronizing. The better show does not tell in a long way but shows directly, so they catch the meaning of the content they read. Meanwhile, Kusuma explained that when reading books with educational content, it is essential to provide illustrations and pay attention to book design so that children do not get bored and even arouse their curiosity. The visuals presented are not abstract since children can easily understand the meaning of the images.

Researchers conducted interviews with 30 children in the age range of 5 to 8 years. It discovered that some kids were scared of the idea of the sea because it seemed terrifying, but if presented in a humorous and engaging cartoon, it would be fascinating. Others like the sea and beaches, but they are aware of and regret the dirty conditions of the seas and beaches. Children do not know that most of the waste in the sea comes from a household, while people in their society do not introduce them to the concept of environmental friendly. Children are generally interested in books with any story concept as long as they are packaged in a unique, appealing, and exciting way. Book visualizations that appear bright, warm, and fun are more interesting to read.

3.2 Ideation Stage

At the Ideation stage, the data obtained at the Inspiration stage is developed into a concept in the form of an idea. For this reason, reader segmentation, positioning, and tone-and-manner are determined to obtain the right visual communication design work.

Based on the concept as shown at Table 1, the researcher processes the content and context to obtain the proper form. The researchers create a visual approach board and then determine visual elements related to colors, images, typography, textures, and grids.
## Table 1. Analysis as content and context.

<table>
<thead>
<tr>
<th>Analysis</th>
<th>Description</th>
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<tbody>
<tr>
<td><strong>Segment</strong></td>
<td><strong>Primary Target</strong>&lt;br&gt;Demography:&lt;br&gt;• Age: 5 to 8&lt;br&gt;• Gender: Man and woman&lt;br&gt;• Social Economy Status: Middle Class&lt;br&gt;Psychography:&lt;br&gt;• Interested in new things&lt;br&gt;• Likes to read books&lt;br&gt;• Interested in environmental issues, especially the sea.</td>
</tr>
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</table>
| **Positioning statement** | This interactive illustrated book contains education about efforts to preserve the ocean through the habit of managing waste at home in an easy and fun way for children aged 5 to 8.
| **Tone and manner** | • Sunny: to bring out the feeling of joy<br>• Dynamic: encourages a sense of enthusiasm<br>• Imaginative: age-appropriate for children who are full of imagination. |

According to Eisman’s assertion, a Playful color scheme conveys the sense of being energetic, enthusiastic, and excited. Invite people to come out and play. This color scheme is energizing, evoking expressions of smiles, joy, and spontaneity, for children and adults who are young at heart [16]. For this reason, the researchers utilized this color scheme to achieve a bright and cheerful impression of typical children in their daily fun and warmth. The colors used are dominated by blue and yellow. Blue with enough saturation to feel warm, and also as an implementation of the color of the sea. Yellow and red are used as a warm and friendly impression and are synonymous with sand colors, as shown at Figure 3.

**Fig. 3.** Color scheme

The images use illustrations in a spread that completely covers the left and right pages of the book. Ghozali quotes Watson-Guptil, and explains that the function of using scatter illustrations in a layout is an emphasis on an atmosphere and story setting so that readers can spend much time observing the illustrations. This fully rendered spread page illustration is called a spread full bleed illustration [9] as shown at Figure 4.

**Fig. 4.** Illustration of spread full bleed

According to Ghoozali, a story can persuade effectively and impressively since it has strong characters. The illustrator should process the characters, turning the verbal into a visual form. Details of the time setting, location, and description of the characters by the writer are needed to process the characters’ visual (image) that will become the figure in the story. Important to note; (1) The type of characters, whether a human, animal, fictional creature, or inanimate object; (2) The characters’ gender; (3) The character’s age; (4) The time setting, cultural setting, and location where the story takes place for alignment of costumes and attributes [9].

The game of drawing style also influences the texture and drawing techniques. According to Salisbury, with the development of technology and changing times, any media, both two and three-dimensional media, can be suitable to be implemented in children’s picture storybooks. Certain textures could be created by many medium, such as pencil, paint, and ink textures [17].

Hoeestetler said that typography is a critical component in visual communication, partly because it can evoke human emotions by combining shapes with narrative text. Human emotions, which are derived from experiences, can be used to determine the creation of an attractive artwork. Over time, typography has gradually changed in response to various factors such as individual differences, technological advances, and cultural evolution [18]. In this research project, decorative typography is used in the title to create a dynamic and imaginative impression. The body text uses a sans serif so that it is easy for children to read and digest.

**Fig. 5.** Typography with the fonts Gaegu Bold and Regular, Comiquita Sans, and Reality Check

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the physical size and the proportions of the space created. The grid improves the effectiveness and efficiency of design work [19]. Researchers use the grid as a reference for placing dynamic illustrations and scripts so that they are stimulating for children.

### 3.3 Implementation Stage

Based on the Ideation stage, the results carried out further elaboration as development at the Implementation stage in the form of design work. The design work is in the form of a full-illustrated storybook equipped with interactive pages by way of pop-ups. Apart from helping to facilitate understanding, pop-ups also add to the attractiveness of the target market. Education is communicated through a story about a child's average day to make it simple for people to put it into practice.

Books present interactions with their readers through a pop-up format, namely books that can create 3-dimensional shapes when interacted with. According to Dzuanda, there are several benefits of pop-ups for readers, namely: (1) Teaching readers (especially children) to be able to look after books and treat books well; (2) Closer relations between readers (especially children) and their assistants (especially parents); (3) Children get stimulation of creativity and imagination; (4) Pop-up media has appeal to children [20].

According to Dewantari, an interactive lift-the-flap page is a pop-up with a simple mechanism, but convenient for children considering the easy construction. Hence this pop-up technique is popular among children. The viewing, opening, and closing activities contained in the lift-the-flap mechanism can also train children's motor development indirectly [21]. In his interview, Riama also said that if the target audience is very young children, avoid pretentious and complex pop-up storybooks, because they are damaged easily, apart from being difficult to digest. The use of lift-the-flap would be better.

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![Image](image_url)

**Fig. 6.** Display of the cover of the book

Illustrations use soft textures like crayons that seem friendly, appealing, and familiar to children. Some forms become the visual form of each character. For instance, rocks and debris have sharp, triangular, and square shapes that appear rigid, hostile, ominous, and wicked. Then the human and animal figures are made soft with the dominance of rounded shapes for a friendly impression and the implementation of the protagonist's character. With the presence of this dynamic, the visuals can appear attractive, as shown at Figure 6.

This book is titled Emil's Adventure Series: Look! There's Garbage Behind the Coral! This book is the main object of this project. The contents are an introduction to tips on minimizing everyday waste. It has a good impact on the environment, focusing on the marine environment.

Implementing specific forms that may accurately depict each character's traits allows the character designs of the figures in the story to come to life. Emil, the main character, is designed in a spherical shape and has children's proportions that tend to be round. Emil also has an upbeat and lively personality. The character mother of the second main character is compassionate, pleasant yet authoritative and knowledgeable. Therefore, the mother looked at a slightly rounded shape with a mixture of square shapes. The father figure is neutral, simple, and stable as the head of the family. Therefore the primary form of the father is a shape consisting of squares. The color scheme of these characters uses blue and yellow-orange, a characteristic that is also related to the color tone of the book as a whole and creates a friendly impression, as shown at Figure 7.

As a complement, this book has a lift-the-flap page at the end of the book, along with an insert in the form of a Mini Guide Catalog for parents, as shown at Figure 8, 9 and 10. The goal is to make it easily accessible and to be able to disseminate more thorough information than just presenting the book, so that the interaction between the kid and the book will help the message conveyed through the story to be more readily absorbed, understood, and remembered. Parents can utilize the Mini Guide Catalog that has been prepared to help them teach their kids how to manage home garbage in daily life.

![Image](image_url)

**Fig. 7.** Illustration of the characters and their color palette
This mini guide contains ways to minimize waste, followed by introduces waste and alternatives to waste-producing goods, including alternative methods of disposing of waste to make you more aware. On the backside, the guide is assembled with an activity sheet for living an environmentally conscious life. This activity sheet can be accomplished both by parents and kids, fostering greater family engagement. As part of their educational objectives, while marketing this book, researchers also produced visual artworks that were posted on Instagram. The design adheres to the grid that Instagram used to create varied and appealing information presentations. Many supporting artworks feature Emil as the main character with various expressions and gestures that increase the emotional attachment between Emil and the children's readers, as shown at Figure 11.

At the implementation stage, researchers asked for information from parents who have children aged 5 to 8 years. The comment from the intended audience of parents is that they enjoy this book since the illustrations are appealing to children, and convey good moral values as well as knowledge that will be valuable to them as future generations.

4 Conclusion

The family, the smallest unit of society, plays a crucial part in preventing an increase in the amount of household trash generation. To live with sustainable lifestyle, a family must become accustomed to consuming items that have the potential to become garbage and become mindful of living an environmentally friendly lifestyle. In order to foster an attitude of concern for environmental sustainability, it is necessary to introduce each family member to the concept of waste management and to implement habituation. Habits are easily formed when introduced early on and carried out consistently as part of daily education at home. Children, who are considered to be the world's future, need to be aware of the necessity to work toward a sustainable and safe living environment for all forms of life to ensure their own existence in the future. Books are a medium that is timeless and can be accessed anywhere, so they are considered appropriate to be used in introducing knowledge about environmental awareness to children, particularly those aged 5 to 8. The researchers concluded that age-appropriate storybooks could help raise early childhood awareness of sustainable living. The story is told illustratively by presenting characters that are close to everyday life. By fusing contemplative themes in a cheerful and humorous manner combined with encouraging emotional connections, the lessons presented in this book could be more accepted pleasantly by
children. As a follow-up research, books can be serialized with the same characters but with different background stories.

References