

The Making of an Interactive Illustrated Book on Coral Reef Ecosystems

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Abstract:

Indonesia, as a tropical archipelago with high marine biodiversity, possesses coral reefs that harbor thousands of species. However, more than 36% of coral reefs in Indonesia have been damaged due to climate change, pollution, and human activities. This damage not only impacts marine ecosystems but also the economy and human welfare, as coral reefs provide coastal protection, support tourism, and serve as a source of food for fisheries. Despite this, previous research has shown that knowledge and awareness among the public, especially the younger generation, regarding the importance of preserving coral reefs is still quite low. Therefore, this study aims to design an interactive information medium in the form of an interactive illustrated book that is expected to increase students' or children's understanding of coral reef ecosystems, especially in Indonesia. The design method used in this design refers to the theory of children's book creation by Denise I. Matulka. With direct interaction in this medium, it is hoped that students will be more aware and concerned about the importance of preserving coral reefs and their impact on the environment and their lives.

Keywords: Coral reef; Interactive media; Illustrated book; Young generation

1. Introduction

Coral reefs not only serve as habitats for diverse marine life but also play a crucial role in protecting coastlines, providing food sources, and supporting the economic activities of coastal communities (Maturbongs, 2024). A case study conducted by the Research Center for Oceanography at the Indonesian Institute of Sciences (LIPI) in 2018 found that Indonesia's coral reefs account for 18% of the world's total reef area. However, more than 36% of them have suffered damage due to climate change, pollution, and human negligence.



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Efforts to conserve coral reefs must begin with education on environmental awareness and the importance of these ecosystems. This is a fundamental step in fostering a sense of responsibility among the public (Mawaddah et al., 2023, p.223). Unfortunately, a study by Runianto in 2019 (Amani et al., 2021, p.38) revealed that Indonesians' understanding of marine ecosystems, including coral reefs, remains very low. One of the primary causes is the lack of early education on marine topics. The Indonesian education curriculum, particularly at the primary and secondary levels, often does not allocate enough focus to marine science (Prastianto et al., 2022, p.127). As a result, many people struggle to connect their daily activities with the health of coral reefs.

Students, as the future generation, need environmental education from an early age to help shape their behavior and mindset toward nature (Uar et al., 2016, p.95). However, marine literacy in Indonesia remains limited, especially among young people living far from coastal areas (Sukri et al., 2020, p.1). Research indicates that knowledge about marine ecosystems is still concentrated within fishing communities and has not been widely passed down to younger generations, particularly those in urban areas (Mawaddah et al., 2023, p.223). The lack of educational media on this topic means that students in cities generally have a weaker understanding of the ocean compared to their peers in coastal regions.

Field observations show that most educators still lack effective teaching strategies for science-related subjects (Juhardi & Amirullah, 2022, p.52). Traditional learning methods that rely solely on textbooks are often seen as monotonous by students and do little to instill environmental values. Studies suggest that storytelling and narrative-based learning can be an effective approach to conveying moral messages and evoking emotional responses in children (Siregar et al., 2020, p.726). In addition to enhancing cognitive abilities, this method can also help raise children's awareness of social relationships and the importance of environmental conservation. This study aims to answer the following research question:

1. How can an interactive illustrated book be designed to educate readers about coral reef ecosystems?

2. Methodology

The design technique used in this study follows a qualitative method, which includes interviews, questionnaires, literature review, and reference studies.

Interviews were conducted online via Zoom or Google Meet at pre-arranged times with expert sources.

- The first interview was with Gagah Gumelar, a marine expert, to understand public perceptions of coral reefs and the importance of public education on the subject.
- The second interview was with David Kristian Thio, a children's book illustrator, to explore the technical aspects of illustrating children's books to both engage young readers and convey moral messages effectively.

- The third interview was with Alnurul Gheulia, a children's book author and illustrator, to gain insight into the creative process of writing children's stories.

Questionnaires were distributed using a sampling method to children aged 8–13 in the Jabodetabek region. The questionnaire was designed to assess their level of understanding and perspectives on coral reefs. A total of 56 respondents participated, revealing that the majority of children had relatively limited knowledge about coral reefs.

Existing studies were conducted by analyzing books similar to the research objective, particularly the interactive book "Look Inside a Coral Reef". The book was examined in terms of content, visuals, interactivity, and language style.

Reference studies focused on analyzing other interactive books used as design references, including "The Ultimate Book of Space," "Ancient Asia," and "The Little Mermaid." This method was used to gather insights for book design and the use of interactive features.

The design methodology in this study follows Matulka's (2008, pp.19-22) framework from his book, *A Picture Book Primer: Understanding and Using Picture Books*. Matulka outlines five key stages in the development of picture books:

1. Creation – The stage of gathering and processing information on the design topic.
2. Acquisitions – The stage of developing visual concepts and content.
3. Planning and Design – The stage of designing illustrations and visual assets.
4. Production – The stage of producing the interactive book in physical form and conducting alpha testing.
5. Marketing – The stage of designing secondary media.

3. Result

The design process began with brainstorming ideas using a mind map, followed by developing the big idea, creating a mood board, selecting a color palette, and gathering design references. This book presents the adventure of a child exploring coral reefs, highlighting their beauty, biodiversity, and the importance of marine conservation. The title of the book, "Ada Rumah di Bawah Laut" (translated as "*There's a Home Under the Sea*"), emphasizes the idea that coral reefs serve as a home for various marine life.



Figure 1 Interactive Book Cover.

To provide a comprehensive understanding of the creative process, the following table provides a detailed explanation of the overall process:

Table 1 Design Stages and Interactive Feature Development

Stage (Matulka's Framework)	Key Activities	Interactive Features Developed	Purpose / Educational Aim
1. Creation	Conducted interviews with marine experts and children's book authors; literature review on marine education	Identified key themes for interactive scenes (e.g., coral bleaching, reef biodiversity)	Ensure accurate and age-appropriate marine content
2. Acquisition	Developed mood board, visual language, target age group definition	Defined art style (simple and stylized), selected color palette	Make visuals attractive and accessible for 8–13-year-olds
3. Planning and Design	Storyboarding, illustration design, drafting interaction points	Designed pop-up corals, lift-the-flap facts, textured elements, sorting-out-trash feature	Encourage hands-on exploration and reinforce learning through play
4. Production	Printed prototype, alpha test	Refined interaction mechanisms (ease of lifting, durability)	Improve usability and engagement based on real feedback
5. Marketing	Developed promotional media and merchandise	Designed Instagram ads, plush toy, reusable tote bag and stickers	Extend brand awareness; promote environmental identity and pride

The illustrations follow a stylized approach, simplifying complex forms to ensure the information is easily understood by children. In addition to the illustrations, the book incorporates interactive features such as pop-ups, lift-the-flap elements, textured pages, and other engaging components. The book was tested by 81 users, whose feedback provided valuable insights. Based on their input, revisions were made to the book's visual elements and interactive features to enhance its appeal, functionality, and engagement before reaching its final version.

Finally, supporting media were designed to promote the interactive book "Ada Rumah di Bawah Laut." These promotional materials include an Instagram social media campaign, a mini-X-banner, and various merchandise such as tote bags, plush toys, and stickers.



Figure 2 Final Overall Book Design.

4. Discussion

To evaluate the effectiveness of the designed book, a beta test was conducted to assess its visual design, content, interactivity, and the overall learning impact. Children responded positively to the interactive features such as lift-the-flap pages and pop-up corals, reporting increased enjoyment and curiosity. These features were purposely created to help children learn better. For instance, lift-the-flap components were placed on pages containing key facts about coral inhabitants and coral bleaching, allowing children to actively engage with the content rather than passively read it. This tactile interaction aids retention and emotional engagement, as supported by cognitive learning theory.

Moreover, the simplified illustration style served a dual function: reducing visual complexity for ease of understanding and making the marine environment feel approachable and inviting. The choice of bright, saturated colors aimed to capture attention and create a cheerful tone that encourages learning. These decisions were not aesthetic alone, but grounded in the broader aim of instilling environmental empathy in young readers.

Feedback from children also highlighted areas where text needed to be simplified, leading to revisions that made moral messages about conservation more digestible. As a result, the book's design evolved in direct response to user interaction, ensuring alignment between visual/interactive choices and the overarching goal of marine ecosystem education.

5. Conclusion

The interactive book on coral reef ecosystems was designed to raise awareness and enhance children's understanding of marine biodiversity, particularly coral reefs. The book features a

cheerful visual style, bright colors, simple language, and interactive elements such as pop-ups and lift-the-flap components to create an engaging learning experience.

The design process began with data collection, mind mapping, and concept development. The results of beta testing indicated that the book was effective in improving children's understanding of coral reefs.

The interactive book on coral reef ecosystems was designed not only to raise awareness but also to actively engage children in learning through hands-on and visual experiences. By integrating educational goals into the design—such as using simplified illustrations, interactive features like pop-ups and lift-the-flap pages, and a relatable storyline—the book aims to enhance children's understanding and emotional connection to marine biodiversity. Feedback from user testing confirmed that these features effectively supported learning and retention. The design process, based on both learning principles and feedback from users, shows how visual and interactive elements can be powerful tools for teaching about the environment.

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Beatrice Xavier is a designer student with interests in marine conservation, environmental education, and children's interactive learning materials. One of their past work focuses on developing engaging educational media to promote ocean literacy and sustainability awareness among young learners.