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Applying the Values of Local Wisdom of Samudra Kerthi in Animated Films as a Learning Medium for Early Childhood: A Case Study in Bali

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Abstract

This study aims to develop a 2D animated learning medium for Early Childhood Education (ECE) that integrates the Balinese local wisdom of Samudra Kerthi as a strategic effort to instill environmental awareness from an early age. The urgency of this research is driven by the escalating waste crisis in Bali, particularly its impact on coastal and marine ecosystems, which necessitates educational strategies capable of fostering pro-environmental behavior in children. The development process follows the ACIA framework (Analyze, Creation, Improvement, Artwork). The Analyze phase involves identifying the requirements for effective media to stimulate environmental stewardship. The Creation phase encompasses designing animations tailored to aesthetic principles, developmental psychology, and the learning characteristics of young children. The Improvement phase was conducted through expert validation, practitioner feedback, and small-group trials to ensure conceptual clarity and audiovisual appropriateness. Findings from structured observations and teacher interviews indicate that 88% of the children comprehended the moral message and exhibited a high level of engagement with the animation. While the scope of this study remains limited to small-group trials with a brief observation period, media experts have confirmed that the animated product adheres to both pedagogical and aesthetic standards for ECE. These results suggest that local wisdom-based animation holds significant potential as an alternative medium for introducing environmental stewardship in early childhood.

Keywords: *Samudra Kerthi, two-dimensional animation, learning media, Early Childhood Education, local wisdom, environmental awareness, ACIA model.*

Abstrak

Penelitian ini bertujuan mengembangkan media pembelajaran untuk Pendidikan Anak Usia Dini (PAUD) berupa film animasi dua dimensi yang mengintegrasikan kearifan lokal Bali, yaitu Samudra Kerthi, sebagai upaya menanamkan sikap peduli lingkungan sejak usia dini. Urgensi penelitian didasari oleh meningkatnya permasalahan darurat sampah di Bali, terutama yang berdampak pada kawasan pesisir dan laut, sehingga diperlukan strategi edukasi yang mampu membentuk perilaku ramah lingkungan pada

anak. Pengembangan media menggunakan model ACIA (Analyze, Creation, Improvement, Artwork). Tahap Analyze memuat identifikasi kebutuhan terhadap media yang efektif dalam menstimulasi kepedulian lingkungan. Tahap Creation meliputi perancangan animasi yang disesuaikan dengan aspek estetika, psikologi perkembangan, serta karakteristik belajar anak usia dini. Tahap Improvement dilakukan melalui validasi ahli, masukan praktisi, dan uji coba kelompok kecil untuk memastikan kejelasan pesan dan kesesuaian audiovisual. Berdasarkan hasil observasi terstruktur dan wawancara dengan guru pendamping, hasil menunjukkan bahwa 88% anak memahami pesan moral yang disampaikan dan menunjukkan ketertarikan terhadap animasi. Penelitian ini masih terbatas pada uji coba kelompok kecil dengan durasi pengamatan yang singkat. Ahli media menyatakan bahwa produk animasi ini telah memenuhi standar pedagogis dan estetis untuk pembelajaran PAUD. Hasil ini mengindikasikan bahwa animasi berbasis kearifan lokal memiliki potensi yang baik untuk digunakan sebagai media alternatif dalam pengenalan lingkungan usia dini

Kata Kunci: *Samudra Kerthi, animasi dua dimensi, media pembelajaran, Pendidikan Anak Usia Dini, kearifan lokal, kepedulian lingkungan, ACIA.*

1. INTRODUCTION

Bali is an island in Indonesia and a world-class tourism destination. Early Childhood Education (ECE) plays a crucial role in supporting the preservation of culture and nature as the foundation for sustainable life [1] . ECE in Bali refers to a curriculum that emphasizes protecting nature and the surrounding environment, including introducing marine ecosystems and efforts to preserve the ocean [2].

Learning activities for early childhood incorporate cultural approaches based on local wisdom known as Samudra Kerthi. Through this educational framework, children are taught to recognize various forms of marine life and understand the importance of protecting the ocean as a shared habitat for all living beings [3]. Samudra Kerthi represents a systematic effort to preserve the ocean and its natural resources, encompassing both tangible and intangible dimensions (skala and niskala) [4]. Various traditional ceremonies in Bali—such as nangluk merana, melasti, nganyut abu jenazah, nganyut sekah, and mapekelem—symbolize communal commitments to upholding marine sustainability.

The urgency of implementing these values is underscored by Bali's environmental crisis, where a 2025 report highlights severe plastic pollution threatening coastal ecosystems and protected marine wildlife. This has prompted the government to initiate educational programs from an early age. Furthermore, the government encourages all Balinese communities to actively reduce waste through individual awareness and independent action to prevent further environmental damage, particularly to marine ecosystems [5], the bali island is facing an escalating waste crisis, particularly due to incoming waste and tourism-related pollution that the government has struggled to manage effectively. In marine environments, plastic waste is highly dangerous; many marine animals ingest plastic, mistaking it for food, which leads to poisoning and death [6][7]. Reports from Betahita.id (2018) and CNN Indonesia[8] highlight cases in Bali where sea turtles and sperm whales were found dead with large quantities of plastic waste in their digestive systems, including a whale discovered with more than 100 kilograms of plastic lodged in its stomach.

The Bali Provincial government supports this effort through Bali Governor Regulation No. 24 of 2020 [9] on the Protection of Lakes, Springs, Rivers, and the Sea, aligned with the principles of Segara Kerthi and Danu Kerthi (water conservation) [4]. Therefore, education based on the broader local wisdom framework of Sad Kerthi is promoted to strengthen environmental awareness among children from an early age [10]. In this context, the development of appropriate learning media becomes essential for fostering environmentally responsible behavior, particularly regarding marine preservation, among young learners.

Observations conducted by the researchers on ECE practices in Bali during the 2022–2025 period indicate that teachers continue to rely on conventional instructional materials, such as static two-dimensional images, which limit creativity and imagination in early learners. Therefore, the development of animated films is considered vital as a form of creative educational media that aligns with children's learning preferences, enabling more effective and context-appropriate knowledge transfer [11] [12].

Recent international literature indicates that 'dialogic reading' (active conversation) enhances children's vocabulary and visual literacy more effectively than static media. A study by Hoel and Jernes (2020) found that animation accelerates children's visual comprehension of depicted environmental issues, thereby fostering vocabulary development (1). Furthermore, Barak and Assal (2018) emphasize that the integration of local cultural values into digital media can increase children's empathy toward their surroundings. Animation enables children to visualize invisible processes—whether microscopic or abstract—which is crucial for the formation of cognitive schemata in early childhood. To address the challenges of conventional learning media and the urgent need for local-wisdom-based environmental education, this study aims to develop a learning medium in the form of a two-dimensional animated film that integrates the local wisdom of Samudra Kerthi. The media development process utilizes the ACIA (Analyze, Creation, Improvement, Artwork) model, an approach that guides the creative work process. The resulting animated film is expected to effectively support knowledge transfer[13]and foster an environmentally conscious attitude toward the marine environment from an early age. Although various literatures have discussed the application of animation in Early Childhood Education (ECE), there is a lack of research specifically focused on developing interactive 2D animation that integrates the Balinese local wisdom of Samudra Kerthi as a medium for marine environmental education. Consequently, this study aims to fill this research gap. Based on the aforementioned problem identification and research gaps, the research questions of this study are: (1) How is the design process of 2D animation based on Samudra Kerthi local wisdom conducted using the ACIA model? and (2) What are the levels of comprehension and engagement among early childhood learners toward the animated medium?

2. RESEARCH METHODS

This study employs a Research and Development (R&D) approach to design and evaluate the feasibility of instructional media. The developmental model adopted in this study is the ACIA approach.The methods used in this study to analyze and present the results of the data obtained are qualitative and quantitative methods [14] with the stages of creating artwork through the Analyze, Creation, Improvement, Artwork (ACIA) approach. The ACIA model was selected over general instructional models, such as ADDIE, because it specifically facilitates the visual exploration process and the final artwork stage, both of which are critical in 2D animation production

The creative work is tested on content experts, learning media experts, and visual communication design experts who have an academic and practical background in their respective fields. The creative work was tested on early childhood children with a sample group of 30 students [15].

The ACIA method inherently integrates qualitative and quantitative research approaches at every stage. A qualitative approach was dominant in the initial stage, namely Analyze, and was used to collect contextual data (characteristics of early childhood, local cultural values of Sad Kerthi, and comparative studies of animated films). The results of this qualitative analysis then became the foundation for the Creation stage, where the concept was translated into a tangible product through scriptwriting, storyboarding, character design, and visual rendering.

The product trial (Improvement phase) involved 20 early childhood students and two assisting teachers at PAUD Dwijendra Denpasar. Participants were selected using a purposive sampling technique, based on the consideration that the school incorporates local culture into its vision but has yet to optimize the use of interactive digital media. Data were collected through structured observations and interviews. Prior to implementation, the research

instruments were validated by two experts—an early childhood education specialist and a visual media specialist—to ensure that the question indicators aligned with children's cognitive development.

Qualitative data from expert feedback and teacher interviews were analyzed using qualitative descriptive analysis (data reduction, data display, and conclusion drawing). Meanwhile, quantitative data from student observation sheets were analyzed using descriptive statistics, specifically calculating feasibility percentages and comprehension levels. The scores were then categorized using a Guttman scale with criteria of 'appropriate' or 'inappropriate
The final stage, Artwork, is a representation of the validated and improved creative work. This artwork not only focuses on visual beauty but must also meet educational and interactive criteria, be suitable for early childhood development stages, and explicitly contain elements of Sad Kerthi local wisdom.

Thus, the ACIA model ensures that this research produces a robust teaching media product, both in terms of development methodology, artistic validity, and educational effectiveness. Here's an explanation of each stage of ACIA.

2.1 Analysis

The analysis method is the process of collecting, examining, and interpreting data or information to understand the needs and learning context of early childhood children. In creating media learning designs with local wisdom insights, this method is used to determine how children's characteristics, local cultural values, and their social and cultural environment can be used as a basis for developing appropriate and meaningful media.

The analysis stage in creating digital teaching media artwork for early childhood includes a series of preparations before the creation process begins. This stage ensures that the basic concepts and plans have been well-designed before proceeding to the more intensive creation stage. This analysis stage consists of:

a. Determining goals and objectives: defining the learning objectives and targets to be achieved through digital teaching media for early childhood. At this stage, it is ensured that the content aligns with the development of early childhood.
b. Concept development: Developing a concept for the overall design of the digital learning media, including the storyline, character design, and learning activities.
c. Scriptwriting: writing the script that will be used in the learning media. In this stage, the language used must be appropriate for understanding early childhood children. Telling stories in language is beneficial support in creating works.
d. Storyboard Design: Creating a storyboard serves to visualize the storyline and layout of visual elements in the teaching material.
e. Determining Art and Design Styles: selecting art styles, colors, and visual designs that are appropriate for the needs of early childhood audiences. We adjust design elements to cater to the esthetic preferences and needs of children, taking into account the principles of early childhood psychology.

2.2 Creation

The creation stage in the making of digital learning media artwork for early childhood is the part where the ideas/concepts designed in the analysis stage are realized into an actual product. The creation process will involve the implementation of various elements, including visual design, animation, sound recording, and the integration of interactive elements. The creation stages are carried out as follows.

a. Visual Content Creation: implementing character designs, backgrounds, and other visual elements according to the storyboard.
b. Animation or Interactive Creation: In this case, the learning media involves elements of images, animation, or interactivity. Creating animations or integrating interactive elements can enhance children's understanding.
c. Voice Recording: record the necessary dialog, narration, or sound effects. The sound produced is friendly and easy for early childhood to understand.
d. Rendering/publishing applications that function to integrate all editing components to produce work in the desired format, such as H264 in the form of an MP4 file.

2.3 Quality Improvement

The improvement process in design work is a stage for correcting, refining, and developing design results to make them better, more functional, and more suitable for user needs. This process is carried out after the design work has been evaluated, either through testing, user feedback, or self-reflection by the designer.

The enhancement stage in the creation of digital teaching media artwork for early childhood occurs after the production process is complete. This stage involves a series of actions to ensure the product is optimally ready for use, as well as providing maintenance and improvements if necessary. The process of improvement consists of:

a. Initial evaluation
b. Observing and assessing the media that has been created, considering visual appearance, content, and engagement with children.
c. Testing and Evaluation: conducting internal trials to ensure that the learning media functions well and aligns with the learning objectives.
d. Identify weaknesses and strengths, and determine which parts are less effective, confusing, or not in line with local culture, as well as aspects that are already working well.
e. Improvement and Development: Making changes to design elements such as color, illustrations, layout, content, and delivery methods to make it more appealing and suitable for children's needs.

Throughout the entire creation process, it's important to involve early childhood education experts and listen to input from the target audience so that digital teaching media can be an effective and relevant tool for early childhood learning.

2.4 Art Work

Artwork is a high-quality creative work; in this case, digital learning media designs for early childhood are products capable of effectively, enjoyably, safely, and appropriately supporting children's learning processes and are in line with their developmental stages. This design work is not only visually beautiful but also has educational and interactive value and contains cultural elements relevant to the local wisdom of Sad Kerthi.

Characteristics of quality creative works include being appropriate for the age and developmental stage of children, where the design must adapt to the cognitive, language, motor, and socio-emotional abilities of early childhood. For instance, the design incorporates bright colors, simple shapes, and facilitates easy navigation. The design also has a clear educational value, where content should be designed to help children learn basic concepts such as letters, numbers, colors, shapes, or social values (e.g., helping others, good manners).

The design created should be interactive and engaging, meaning that effective learning media can actively involve children, for example, with sound, animation, simple games, or activities that stimulate curiosity. In the topic discussed, the work certainly contains elements of Sad Kerthi local wisdom. The work meets the criteria of being safe and child-friendly.

3. RESULTS AND DISCUSSION

Here are the results and discussion for each stage of the ACIA method.

3.1 Analysis stage

The initial stage in this research is the analysis stage, which serves to obtain relevant data and analyze it so that the research aligns with expectations. This stage aims to explore the necessary data from early childhood education. The analysis begins with the students' need for learning media and the government's need to educate early childhood. The independent curriculum for early childhood education includes topics about fish in the sea, food, and the surrounding environment. This study has the potential for the media to provide opportunities to introduce marine life to early childhood [16].

From an interview with Ms. Astari, Head of the Bali Provincial Fisheries and Marine Service, it was stated that the sea in Bali is polluted due to the rainy season, which causes a lot of waste to be washed into Bali. Such pollution causes the quality of seawater to deteriorate and will definitely disrupt the ecosystem, so we must

maintain the quality of plastic waste. In the long run, plastic waste will definitely have a negative impact if consumed by marine fish. Efforts to keep the sea clean include cleaning the sea by the community, children, government, and fishermen so that animal habitats in the ocean can be rehabilitated.

The description suggests the need for a creation process that takes into account three key elements: early childhood education, the government's role, and a local wisdom approach. Local wisdom is needed to provide a socio-cultural approach for early childhood, thus accelerating the knowledge transfer process. Certainly, the educational needs of early childhood should be able to translate the ocean's depths into the students' imaginations, making them interested and striving to understand the topic and its application in life. The philosophical values of Samudra Kerthi, which essentially advocate for harmony and the purification of the ocean, represent a terminology that is too abstract to be conveyed literally to early childhood students. Consequently, this study employs a contextual pedagogical approach to translate these noble values into empirical actions relevant to children's cognitive levels. Rather than utilizing dense cultural terminology, the Samudra Kerthi concept is simplified into cause-and-effect narrative scenarios, such as scenes depicting the rescue of marine animals by properly disposing of waste.

Through behavioral modeling demonstrated by the protagonist, this animation facilitates a social learning process. The children do not merely observe; they are encouraged to imitate the character's positive actions. Thus, the internalization of environmental conservation values occurs naturally, effectively fostering character building without being overly didactic

3.2 Creation stage

In this stage, a learning medium is designed thru the media creation stage. Based on the analysis of the available data, creation was carried out by incorporating elements appropriate for the early childhood curriculum. The concept in creating the animation is a cheerful one. This concept is conveyed in the form of learning with happiness [17].

In learning, children will be introduced to the atmosphere of the ocean environment, which consists of coral, fish, water, and some living creatures within it. The figures used as the identity of living creatures in the Bali Sea are the Mola mola fish and turtles. The choice of the Mola mola fish was inspired by a water mascot in Bali, specifically in Nusa Penida.

Turtles are rare and protected animals that have a habitat on the island of Bali. These fish and turtles appear as part of the tourism on the island of Bali. In this animation, a Mola mola fish adventures in the Bali Sea but finds a large amount of garbage piled up and polluting the ocean.

This animation has an educational feel through the questions asked and the answers received due to the presence of waste in the ocean. Some of the animated characters included in this story are whale characters, clownfish, and sea turtles, which are often found in the Bali Sea.

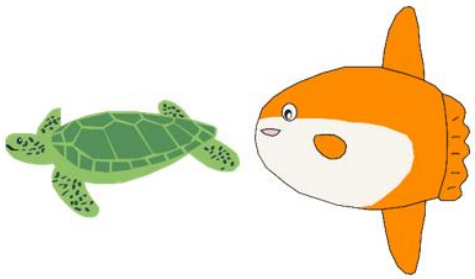


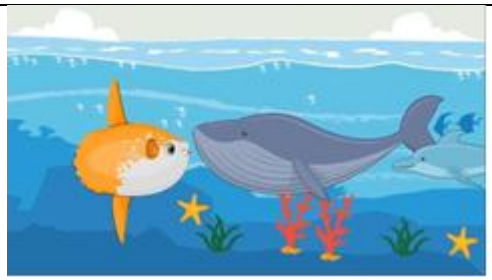
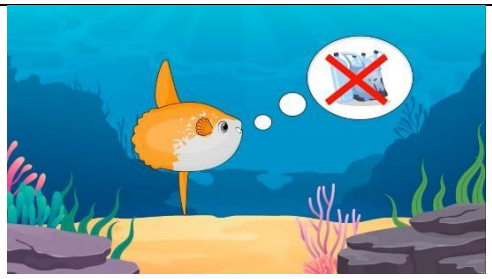
Figure 1. Illustration of a Sea Turtle and a Mola mola Fish

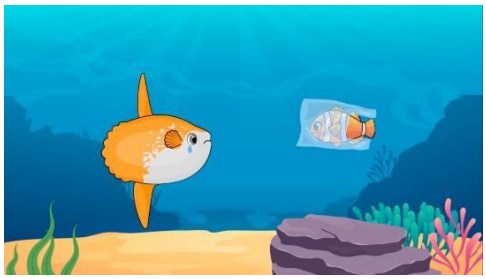
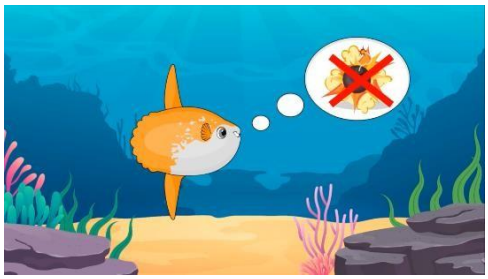
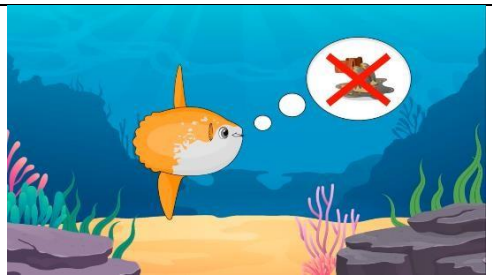
In the visual design phase, shape language is deliberately employed to communicate the inherent nature of each subject within the animation. The protagonist is constructed using a dominance of curved forms (circles and ovals), which psychologically evoke a sense of safety, warmth, and friendliness for early childhood audiences. Conversely, threatening elements—such as piles of plastic waste—are depicted with sharp angles or irregular shapes to symbolize danger and disorder.

Furthermore, character proportions are adjusted using a visual deformation approach, where the head is rendered larger in relation to the body. This figurative characteristic is not merely intended to create aesthetic appeal; rather, it serves as a symbol of innocence that is

equivalent to the audience's own persona. By employing a visual design that accounts for child psychology, the participants' affective filter can be lowered, rendering them more receptive to the messages presented. In the story scenario, scenes containing the dialog and narration that will be used are included. The story conveys the sadness of the fish seeing their friend in an environment full of garbage. They invited the children to join them in taking care of their environment together. The media format is a 2D animated film titled "Protecting the Ocean's Nature." The duration is 3 minutes with a PAL format and a working layer size of 1280px x 720px, 25 fps. The next step is the editing process in animation software. At the end is the rendering process, which produces an MP4 output for easy playback on digital television devices. The visualization of the 2D animated film depicting the ocean's natural environment can be seen as follows:

Table 1: Visualization of the 2D animated film

No of scene	Description	Visualization of scenes
Scene 1	The opening of the 2D animated film, showcasing the animation's title: "Protecting the Ocean's Nature."	
Scene 2	This scene features a Mola Mola fish explaining the marine environment	
Scene 3	In this scene, the Mola Mola fish is shown explaining that people should not litter because it can pollute the ocean.	
Scene 4	In this scene, the Mola Mola fish finds a lot of plastic waste in the ocean, which makes the fish sad.	

Scene 5	In this scene, a Mola Mola fish finds a turtle struggling to swim due to trash.	
Scene 6	The Mola Mola fish saw the clownfish in the plastic waste, and of course, the clownfish needed help.	
Scene 7	In this scene, the Mola Mola fish explains that catching fish should not be done using bombs because it can damage the fish's habitat.	
Scene 8	In this scene, it is explained that waste should not be dumped into the ocean, and the ocean is kept clean to maintain a healthy environment.	
Scene 9	In this scene, the message is conveyed that the ocean can be loved and its sustainability preserved.	

Scene 10	This scene describes the closing part where the situation takes place in the Balinese ocean environment. The bentar gate and meru bali settings serve as the background for this illustration.	

3.3 Improvement stage

In the Improvement stage, there was input from media expert Mr. Adi Sudianggara, S.Kom., M.Ds., an academic and animation practitioner. He stated that animated films can certainly capture the attention of early childhood. What needs to be ensured is the content inside.

In this case, it is viewed from the perspective of the interests of early childhood. The animation should be synchronized between the learning and the story in the film. The animation displayed is already looking good. From every visual display in the animated film, it conveys the information that waste and negative activities in the ocean will have a dangerous impact on the environment and the habitats of marine animals. Therefore, every human being is required to love and protect the ocean for life.

The steps in improving the quality of the work are through testing conducted on groups of students and media experts. The testing was conducted using the Guttman scale approach. The Guttman scale is a data measurement method that provides two clear answer choices (yes/no, agree/disagree). This is done to measure the extent to which respondents agree or disagree with a hierarchically structured topic.

The testing was conducted on a small group of 5-6 year old children. The testing was accompanied by a teacher who explained the purpose of question [18]. The testing discusses the effectiveness of the animated work created. The results obtained are as follows.

Table 2. Test Results

No	Question	Respondent's answer	Frequency	Precentage (%)
1	Students were interested in the animated films that were shown.	Yes	4	80
		No	1	20
2	Students understand the meaning/message conveyed in this animated film.	Yes	4	80
		No	1	20
3	Students like the appearance of the characters in the animation they watch.	Yes	4	80
		No	1	20
4	The dubbing (dubber) is easy to understand and clear in pronunciation.	Yes	5	100
		No	0	0
5	This animated film makes children aware of protecting the oceans.	Yes	5	100

In the small group test, it was reported that 88% of respondents liked and understood the animation shown. Academics and practitioners of animation, specifically Mr. Adi Sudiangggara S.Kom., M.Ds., evaluated the media expert in this case. The media expert stated that he

answered "yes" (100%) to all questions, including whether the animation quality was satisfactory and interesting, whether the visual meaning was understood, whether the character appearance met the needs of early childhood, whether the sound quality was satisfactory, and whether the information conveyed met the needs of early childhood [19]. Based on the field trial results, data indicate that 88% of the child participants were able to identify the primary message regarding the hazards of marine plastic waste. This high level of comprehension can be interpreted through the lens of dual-coding theory, wherein visual stimuli in the form of motion graphics combined with auditory stimuli (music and sound effects) are proven to extend the generally limited attention span of early childhood students. This audiovisual synergy facilitates the children's memory retention of environmental materials.

While these results suggest that local wisdom-based animation holds significant potential as an alternative medium for environmental education, it must be acknowledged that these findings are limited to a small-scale pilot group. Moving forward, the effectiveness of this medium warrants further investigation across broader populations to strengthen the validity of its long-term impact
Based on the analysis of media design needs for animation, it can be utilized as a supporting medium for early childhood learning by incorporating the local wisdom of Samudra Kerti from the Balinese community.

3.4 Artwork stage

Artwork is the final quality of a work that has completed the creative process, in this case, an animated film. A 3-minute film in MP4 format can be used and played on digital video devices, both on television and Android [20]. A film with a cheerful concept can help early childhood learn about the ocean environment. This film is able to translate environmental situations and enhance the imagination and creative thinking of early childhood.

3.4 Limitation

Here are some of the limitations of our study:

1. This study only measures children's understanding and responses after watching the animated film, but there is no in-depth analysis of the long-term impact on their attitudes and behaviors toward marine conservation.
2. This research was only conducted in Bali, involving 30 early childhood children.
3. This research focuses on the use of animated films as a sole medium for learning.
4. This research uses two-dimensional animation in MP4 format, which can be accessed on digital devices.
5. The animated film created in this study is more one-way (from the film to the children), with little interaction.
6. This research does not compare the effectiveness of animated films with other teaching methods that may be more conventional or have been proven effective.
7. This research only uses media in digital format, which may not always be accessible to all children in less developed areas.

4. CONCLUSION AND FUTURE WORK

This study demonstrates that 2D animation serves not merely as a medium of entertainment but as an effective pedagogical instrument for introducing environmental conservation values. A key insight from this research is that abstract philosophical values, such as Samudra Kerthi, can be successfully internalized by early childhood students when translated through measured visual strategies. The theoretical implications of these findings suggest that successful message delivery is highly dependent on targeted visual design. In this context, the application of approachable shape language, body proportions aligned with children's cognitive development, and strong character symbolism act as a cognitive bridge between complex local wisdom and a child's receptive capacity.
Overall, the integration of the ACIA development model with a visual psychology approach is capable of producing educational media that holistically supports the formation of environmental awareness and character building from an early age
Future work can develop various aspects that were limited in this study, such as conducting long-term tests to assess the impact of animation on changes in children's attitudes and behaviors toward ocean conservation. Additionally, further research could be

conducted in different regions with diverse cultural backgrounds to test the effectiveness of locally wisdom-based animations. The research could also explore the integration of animation with other learning methods, such as game-based or project-based learning, as well as the use of other technologies such as Virtual Reality (VR) or Augmented Reality (AR) to create a more immersive learning experience. The development of interactive animations that allow children to engage with the characters and story should also be tested to increase their participation and understanding. Furthermore, a comparison between animation and other more conventional learning methods could provide additional insights. Future research could also expand the distribution of animations to a wider range of platforms, including in areas with limited technology, to ensure better accessibility.

STATEMENT OF APPRECIATION

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