



Curriculum Development for Early Childhood Education Based on Greening Adaptation for Coastal Environmental Resilience: A Case Study of Rob Disaster in Tirto Subdistrict

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ABSTRACT:

This research and development (R&D) aims to produce and validate an early childhood education curriculum based on adaptation to greening for meaningful and effective coastal environmental resilience in instilling values of environmental awareness and disaster preparedness from an early age. Product validation, conducted by subject matter experts and early childhood education teachers, showed very feasible results with high scores for content validity (96%), design and components (93.33%), and feasibility (95%). These results indicate that the developed curriculum is valid, practical, and ready for implementation. This curriculum serves as a valuable educational tool for teachers and principals, helping them create learning processes that are relevant to the daily lives of children in coastal areas. Although this study proves the effectiveness of the curriculum as a valid and feasible medium of information, the limitations of the short implementation period restrict the observation of long-term impacts. Therefore, further research is recommended to be conducted over a longer period, with a wider geographical coverage, and considering activities such as class outings to evaluate the sustainable impact. Collaboration with relevant parties is also recommended to improve the scalability of this curriculum.

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1. Introduction

As a coastal area, Tirto Subdistrict is easily affected by tidal disasters. Tidal flooding is flooding caused by the ebb and flow of seawater, and this event has a significant impact on the local ecosystem and the lives of coastal communities. Tidal flooding not only causes widespread flooding but also exacerbates land subsidence, which in turn damages the environment and infrastructure in the area. This situation creates serious challenges that require special attention and a sustainable approach to minimize negative impacts. Widespread tidal flooding causes damage to homes, public services, agricultural land, and disrupts the social and economic aspects of coastal communities. Therefore, one important step is through early education, especially at the Early Childhood Education level.

Early Childhood Education is a level of education that facilitates healthy and optimal growth and development of children in accordance with the values, norms, and expectations of society (Magta et al., 2019). Efforts made include intellectual stimulation, health maintenance, nutrition, and providing sufficient opportunities for exploration and active learning. This is so that future generations will have awareness of the environment and the ability to adapt to tidal flooding. Environment-based education can instill values of concern and preparedness for disasters from an early age so that children can grow up to be resilient individuals who contribute to mitigation and adaptation efforts in the future. Based on the results of observations and interviews conducted by researchers at early childhood education institutions in Tirto District in April 2025, it was found that in organizing the curriculum for a series of learning activities, one hundred percent referred to the national curriculum. As a result, the learning process was not effective because the learning activities were not in line with the environmental conditions faced by students on a daily basis. Students also lack understanding when learning activities are not adapted to the surrounding environment. Learning activities that refer to the institution's curriculum are very important to use and develop so that learning activities can be effective. Therefore, the researcher integrated environmental aspects and greening adaptation into the early childhood education curriculum as a strategic step in tackling tidal flooding in Tirto Subdistrict in a more systematic and sustainable manner.

Reforestation is one of the important efforts in maintaining ecosystem balance and reducing the impact of climate change (Jupri et al., 2024). In a spatial context, reforestation is urgently needed, especially for developing cities that are undergoing spatial changes in residential areas. Early childhood education is education that greatly influences a child's personality development. The educational process in childhood begins when the child is in the womb (indirectly), continues during infancy, and lasts until the child is about eight years old. Early childhood education plays a vital role in early development before children enter formal education. Early childhood education

is not only responsible for preparing children academically, but also in social, emotional, and motor skills. In Indonesia, the implementation of Early Childhood Education is regulated by various regulations and laws.

The early childhood education curriculum is a complex and dynamic concept, not just a static document. As explained by (Campbell-Barr, 2025), this curriculum is influenced by various conflicting factors and is not yet fully mature in theoretical terms. (Yunita & Suryana, 2022) emphasize that the development of the PAUD curriculum is a crucial foundation for ensuring that education programs are relevant and effective. This curriculum serves as a strategic effort to adapt to social changes and encourage the exploration of new knowledge (Bahri, 2017). More deeply, the development of the PAUD curriculum is a process influenced by social change, modernization, and ideological conflicts (Yang & Li, 2019). However, this process is highly complex, influenced by various factors, including child development theory, educational philosophy, and socio-cultural context (Castner et al., 2022). An effective curriculum must be organic, culturally relevant, and collaborative; it should not be a rigid document isolated from the realities of society (Mligo, 2024). And (Manyukhina & Wyse, 2019) underline a paradigm shift, namely from a knowledge transfer model to a model that focuses on developing learner agency.

Challenges and Issues in Early Childhood Education Curriculum Development, and one of the main issues that emerges in the literature is the gap between theory and practice in the field. Research shows that although concepts such as dance are recognized as important for child development, their application in the ECE curriculum in Spain is still lacking (Gillanders et al., 2025). Similar problems are found in the literacy curriculum in South Africa, where its implementation is a complex function of curriculum content, teacher methods, and teaching context (Masunga & Van der Merwe, 2023). Various studies highlight significant challenges in the development and implementation of ECE curricula. One major issue is the misalignment between standards, curricula, and assessments (Whitaker et al., 2022).

This misalignment often confuses educators and service providers. (Addahil, 2019) also found a lack of formal affective assessment designs, indicating that the development of children's character and attitudes has not been optimally measured. (Edwards, 2021) emphasizes that a curriculum will not be effective if it only exists on paper. Its implementation must be supported by clear pedagogy that is appropriate to the socio-cultural context. Therefore, organization and curriculum design are fundamental to the development process (Aprilia, 2020). Another challenge is the reduction of the role of teachers. (Poulton, 2025) and (Poulton & Mockler, 2023) argue that education systems that are overly focused on standards and accountability tend to reduce the role of teachers to passive "technicians" rather than active and creative curriculum developers. This hinders professional development, especially for pre-service and new teachers.

Curriculum Paradigm Shift: There has been a paradigm shift in early childhood education curriculum design, where the focus has shifted from mere content to children's interactive experiences. (Waters Davies et al., 2023) argues that the curriculum should prioritize children's voices to ensure the quality and relevance of education. This is in line with the findings of (Loizou, 2020), which recommends a more responsive, holistic, and child-centered curriculum to ensure a smooth transition to the next level of education. However, this shift also poses challenges. Hedges et al. (2018) observed that in some countries, play is no longer considered a natural exploration for children, but rather a rigid tool for achieving predetermined learning objectives. This shift is concerning because it contradicts scientific evidence that children learn best through independent interaction. Therefore, ECE curricula must adopt a more sophisticated and comprehensive approach, such as in emotional development, which recognizes the role of children's cognition and rationality (Vanello, 2025).

The Importance of Systematic Curriculum Management and the Role of Teachers, And to overcome these challenges, (Waluyo et al., 2021) emphasizes the importance of systematic curriculum management. Their research shows that good management can create effective work steps in designing, organizing, implementing, and evaluating the curriculum, thereby contributing positively to the quality of education. In addition, the role of teachers in this regard is crucial. (Harris et al., 2020) argue that teachers must be active leaders in curriculum development, not just passive implementers. This role, known as "curriculum leadership," involves deep thinking about content, assessment, and pedagogy. (Alvunger., 2021) adds that teachers function as "curriculum makers" in the classroom, bridging academic knowledge with students' real-life experiences. This process is not an individual practice.

(Hizli Alkan, 2020) shows that teachers design curricula through their professional networks, which are influenced by the quality of relationships and institutional context. Studies also show that providing teachers with dedicated time for planning, assessment, and development (PAD) is essential (Heikka et al., 2022). (Hizli Alkan & Priestley, 2019) add that teachers' practices in developing curricula are greatly influenced by their reflexivity. Teachers' ability to reflect on their practices is key to understanding how they interpret and adapt official curricula. Thus, the curriculum development process is not merely a technical process, but a highly personal and contextual practice. Therefore, the success of curriculum implementation greatly depends on how policies are formulated and implemented, as well as the role of the social and professional context of teachers in the process (Birbili & Myrovali, 2019).

The relationship between educators, curriculum, and assessment is very close. (Pollitt et al., 2020) found a strong reciprocal relationship between activity implementation, educator beliefs, and teaching practices. The success of a curriculum greatly depends on how educators understand and implement it. Assessment results are used by educators to evaluate the effectiveness of the curriculum and determine follow-up learning. Assessment also plays

an important role. In educational literature, curriculum development and implementation are often the main focus, especially in relation to the role of teachers and the influence of cultural context. Various studies highlight significant challenges, particularly the gap between theory and practice in the field. Studies show that curricula designed at the policy level are sometimes ineffective when implemented.

For example, (Mligo, 2017) found that the implementation of the early childhood education curriculum in Tanzania was hampered by policy issues, a lack of political will, and the influence of local culture. A similar situation occurred in South Africa, where the English language curriculum was considered too rigid and stressful for students, thus failing to meet the real needs in the classroom (Govender & Hugo, 2018). (Taylor et al., 2023) highlighted gaps in the teacher training curriculum, where the topics of inclusion and active play are taught separately, resulting in prospective teachers being unprepared to facilitate inclusive play for children with disabilities. This shows that assessment and curriculum must complement each other to ensure educator readiness.

Curriculum innovation is increasingly focused on children's well-being and holistic development. Social and Emotional Learning (SEL) programs, for example, have been shown to be effective in improving social and emotional competencies, self-regulation, and early learning skills in young children (Blewitt et al., 2018). In addition, there is a push to incorporate new concepts relevant to child development in the modern era. (Grieshaber et al., 2021) propose the concept of “multimodal play” as key for teachers to adapt their teaching practices to the digital world and popular culture of children. Similarly, (Gripton, 2022) argues that patterns should be recognized as “strong knowledge” and become a fundamental part of the early childhood mathematics curriculum, as they have often been neglected. Globally, there is debate about how curricula should promote democratic values and child welfare.

(Brogaard-Clausen et al., 2022) compared curricula in several countries and found that the British curriculum is relatively weak in this regard, although other countries such as China, Colombia, Denmark, and Portugal strongly promote these values. A similar issue was raised by (O'Síoráin et al., 2023), who criticized classroom play activities that are often overly controlled by adults and recommended a rights-based approach, in which children are given control and a voice over their play experiences. This is in line with the view that the curriculum should be oriented towards practices that are appropriate for child development (Kessler & Castner, 2024) to ensure that children benefit from authentic learning experiences.

Curriculum development in the modern era requires a more innovative, relevant, and student-centered approach. (Wang & Lam, 2017) shows that Western game-based curricula have been adapted in China to instill local cultural values. Similarly, (Yang & Li, 2017) also show that curriculum development in Chinese kindergartens is a dynamic process, which successfully combines Western (child-centered) and Eastern (teacher-directed) approaches to achieve a balance that reflects Chinese philosophy. Despite socio-political differences, curriculum innovation in Hong Kong and Shenzhen also shares a fundamental similarity, namely balancing various pedagogical approaches driven by the same Chinese cultural values (Yang & Li, 2018). This shows that an effective curriculum must be culturally relevant and able to integrate different philosophies to create a balanced and harmonious education system. (Wrigley, 2018) argues that the curriculum should combine academic (canonical) knowledge with vernacular knowledge from marginalized groups. The goal is to empower marginalized youth so that they can understand and challenge issues of power. In addition, new concepts such as STEM/STEAM and sustainability are increasingly being integrated into early childhood education curricula. (Aldemir & Kermani, 2016) show that the implementation of a well-designed STEM model is effective in improving preschoolers' understanding. (Wang & Lin, 2025) also found a strong relationship between teachers' ability to design STEAM curricula and their confidence in implementing them. And sustainability (Melis et al., 2025; Ohlsson et al., 2022). (Gripton, 2022) even argues that patterns should be a fundamental part of the early childhood mathematics curriculum.

Although the concept of innovative curricula continues to evolve, there is a significant gap between theory and practice, especially in teacher education. (Williams et al., 2024) found that early childhood education teacher candidates in New Zealand still lack the knowledge and confidence to implement bicultural curricula. This is exacerbated by the dominance of English-based approaches that hinder the advancement of Māori language and knowledge (McKenzie & Toia, 2022). To address this, it is recommended to adopt a framework that prioritizes indigenous worldviews and cultures as the foundation of education. A similar issue also arises in relation to digital competence. Although digital competence is recognized as important at the policy level in Norway, (Undheim & Ploog, 2023) found that it has not been effectively integrated into curriculum plans and teaching practices.

This highlights the need for a clearer definition of professional digital competencies to better prepare prospective teachers. To overcome these challenges, a more collaborative, creative, and efficient approach to curriculum design becomes relevant. (Crites & Rye, 2020) advocate the application of Design Thinking (DT), which can be a valuable approach to curriculum design in various fields. Thus, future curricula must not only be relevant in content but also designed with processes that support effective implementation in the field. Overall, ECE curricula must continue to adapt to changing times without sacrificing fundamental principles of child development (Nuttall et al., 2019). This requires collaboration, ongoing research, and a deep understanding of practices in the field (Woods et al., 2021).

At the same time, it is very important to develop an early childhood education curriculum that emphasizes the environment in order to instill values of awareness and preparedness in facing disasters. Therefore, researchers have taken concrete steps by introducing and testing an institutional Mulok curriculum on disaster mitigation in early

childhood education to help children understand and respond appropriately when disasters occur, through the implementation of fun and interactive learning activities. The development of a curriculum for early childhood education must be in line with local environmental conditions and meet the needs of reforestation as part of a tidal disaster mitigation strategy. Reforestation not only beautifies the environment but also significantly reduces the negative impacts of tidal disasters. Greening not only beautifies the environment but also significantly reduces the negative impacts of tidal disasters.

This is because plants can increase the ability to absorb groundwater and stabilize soil structure, two important aspects in dealing with the threat of tidal flooding that often occurs, especially in the coastal areas of Tirto District. Therefore, it is very important to conduct research to develop an early childhood education curriculum in Tirto District that comprehensively integrates greening adaptation to overcome tidal flooding. This approach ensures that education does not only focus on cognitive aspects but also shapes children's character and instills sustainable environmental awareness from an early age. Curriculum development aims to steer the current curriculum towards the desired educational goals due to the various positive influences that come from outside or from within. In the hope that students can face their future well, curriculum development must be anticipatory, adaptive, and applicable.

Previous research by (Sulchaniya and Waluyo, 2024) Development and Implementation of Independent Curriculum in “Penggerak” Kindergarten: A Case Study of Semarang City, this study confirms that Independent Curriculum promotes inclusivity and local adaptation in early childhood education. However, to obtain a more comprehensive picture, future research needs to be conducted with a longer observation period and broader geographical coverage to evaluate the long-term impact of the curriculum and explore more innovative curriculum design strategies.

2. Method

This study uses the research and development method. The research and development method is a scientific method with steps of researching, designing, producing, and testing the feasibility of a product (Sugiyono, 2019). This Development Research is also based on education (Education Research & Development) which aims to develop and assess the effectiveness of products designed to develop an early childhood education curriculum based on the environment for the study of greening adaptation as a response to Rob disasters in Tirto District. The research was conducted in four early childhood education institutions, namely TK Muslimat NU Karangjampo, TK Muslimat NU Tegaldowo and TK Muslimat NU Jeruksari. The main objective is to develop an Early Childhood Education Curriculum Based on Greening Adaptation for Coastal Environmental Resilience: The Rob Flood Disaster Case Study in Tirto Subdistrict is Students through the principal and early childhood education

teachers as well as through the product development and validation process. The learning media development model uses the ADDIE development model. According to Dick and Carry in (Setiadi et al., 2018), the research development model is grouped into five stages, namely analysis, design, development, implementation, and evaluation. The data collection technique in this development research uses questionnaires or surveys.

Sugiyono in (Alfiani et al., 2018) states that a questionnaire is a data collection technique in the form of questions or statements for respondents to answer. This questionnaire is used to seek the necessary information from respondents in the data collection instrument. This questionnaire contains instruments to assess the opinions of experts or validators regarding the feasibility of the Early Childhood Education Curriculum Based on Greening Adaptation for Coastal Environmental Resilience that has been developed. The instruments used in this development study were the Curriculum Substance Validity Test assessed by subject matter expert one and subject matter expert two, the Curriculum Design and Component Validity Test assessed by subject matter expert one and subject matter implementation expert, the Curriculum Implementation Validation assessed by Early Childhood Education Teacher one and Early Childhood Education Teacher two, and the Media Test and Material Validation assessed by Subject Matter Experts and Early Childhood Education Teachers. This data analysis measures the feasibility of the Early Childhood Education Curriculum Based on Greening Adaptation for Coastal Environmental Resilience so that the value of each aspect can be determined.

The data analysis technique used in this study, namely the Likert scale obtained from the analyzed data, is described and concluded based on the validity criteria qualifications of the Early Childhood Education Curriculum to determine the validity criteria of the developed Early Childhood Education Curriculum product. The next step is to measure the feasibility of the curriculum with a description, namely: Scoring by media experts, subject matter experts, and student responses by categorizing them as very good (5), good (4), fairly good (3), poor (2), and very poor (1). Then, provide a validation assessment using the formula:

$$\bar{x} = \frac{\sum x}{n}$$

Description:

\bar{x} : Average

$\sum x$: Total score

n : Number

Then, based on the above formula, it is converted into the following percentage formula: Maximum score

$$\text{Results} = \frac{\text{Total score obtained}}{\text{Maximum score}} \times 100 \%$$

After that, match the average feasibility of learning media according to Arikunto in (Ernawati, 2017), namely:

Table 1: Eligibility categories for the Early Childhood Education Curriculum Based on Greening

Adaptation for Coastal Environmental Resilience		
No	Score in percent (%)	Category
1.	<21 %	Highly inappropriate
2	21-40 %	Unfit
3	41-60 %	Quite decent
4	61-90 %	Worthy
5	91-100 %	Highly Recommended

3. Result And Discussion

The results obtained from this research and development are in the form of an Early Childhood Curriculum Based on Greening Adaptation for Coastal Environmental Resilience, which aims to instill values of awareness and preparedness for disasters from an early age so that children can grow up to be resilient individuals who can contribute to mitigation and adaptation efforts in the future. Using the ADDIE development model stages from Dick and Carry. The ADDIE stages consist of analysis, design, development, implementation, and evaluation.

3.1. Analysis

The analysis stage is the stage of collecting various sources and information before producing a development product. In this development research, the product to be produced is an Early Childhood Education Curriculum Based on Greening Adaptation for Coastal Environmental Resilience. The collection of these sources and information is a needs analysis required in developing the product. The purpose of needs analysis is to identify development products with the goal of meaningful, effective, and efficient learning processes.

Based on previous research by (Sulchaniya and Waluyo, 2024) Development and Implementation of Independent Curriculum in “Pengerak” Kindergarten: A Case Study in Semarang City, this study confirms that Independent Curriculum promotes inclusivity and local adaptation in early childhood education. However, to obtain a more comprehensive picture, future research needs to be conducted with a longer observation period and broader geographical coverage to evaluate the long-term impact of the curriculum and explore more innovative curriculum design strategies.

The above statement has prompted researchers to develop an Early Childhood Education Curriculum Based on Greening Adaptation for Coastal Environmental Resilience. The curriculum consists of four main components, namely curriculum objectives, learning materials or content, learning methods and strategies, and evaluation. In addition, it is presented based on everyday life so that it is easy for teachers and principals to understand. The aim is to make the learning process meaningful, effective, and efficient, as well as to instill values of awareness and preparedness for disasters from an early age so that children can grow up to be resilient individuals who can contribute to mitigation and adaptation efforts in the future.

3.2. Design

The design stage is carried out to facilitate researchers in designing a curriculum for early childhood education based on adaptation to greening for coastal environmental resilience to be developed. The design stages are as follows: The process of developing a curriculum for early childhood education based on adaptation to greening for coastal environmental resilience requires a data collection stage. The requirements for developing the Early Childhood Education curriculum development product based on Greening Adaptation for Coastal Environmental Resilience are those specified in the analysis stage. After that, the Curriculum Objectives, Learning Materials, Learning Methods, and Evaluation are determined. The curriculum objectives, learning materials, learning methods, and evaluation are the flow that will be designed by the researcher to facilitate the researcher in describing and also showing the steps in creating a product that will be produced. In addition, it aims to explain the steps in creating the product that will be produced, thereby facilitating the process of creating a PAUD curriculum based on adaptation to greening for coastal environmental resilience.

3.3. Development

This development stage is the stage of realizing what has been designed in the design stage to become a product. The results of this product will be tested. The development stages can be described as follows: First, the Curriculum Objectives. Curriculum objectives are clear guidelines or directions on what is to be achieved through an education program. These are the things that early childhood education students are expected to master in terms of knowledge, skills, and attitudes after they complete their early childhood education. Second, learning materials. Learning materials are an important component of the curriculum. These are the knowledge, skills, and values that are selected and systematically arranged to be conveyed to students in the learning process. Third, learning methods. Learning methods are two concepts that are interrelated in the curriculum but have different levels and meanings. Both serve as ways or efforts to achieve predetermined learning objectives. Fourth, evaluation. Evaluation is a

systematic process to measure and assess the extent to which the curriculum objectives have been achieved. This process focuses not only on the final results but also on the entire learning process.

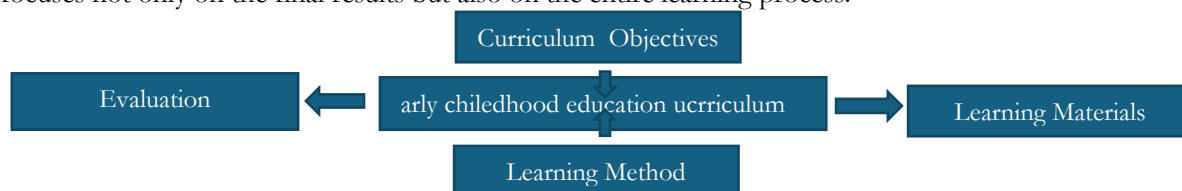


Figure 1: Process of Developing an Early Childhood Education Curriculum Based on Greening Adaptation for Coastal Environmental Resilience.

3.3.1. Design Curriculum Objectives

The first objective of the curriculum is for the cognitive aspect, which aims to understand the basic concepts of the coastal environment and the importance of reforestation, recognize the types of natural disasters that may occur in coastal areas, and learn simple ways to maintain environmental cleanliness and sustainability. The second objective of the curriculum is the Affective Aspect, which aims to foster a love and concern for the natural environment, build a responsive and calm attitude in facing emergency situations, and encourage a spirit of mutual cooperation and collaboration in protecting the environment. The third objective of the curriculum is the Psychomotor Aspect, which aims to master basic skills in planting and caring for plants, be able to carry out simple evacuation simulations with guidance, and be skilled in disposing of waste in its proper place and carrying out simple recycling.

3.3.2. Learning Materials

The first learning material is Getting to Know the Coastal Environment and Greening. Stories and Fairy Tales: Use picture stories or fairy tales about life on the coast, such as the story of a crab that lost its home because of trash, or the adventures of children planting mangrove trees. This helps children understand the concept of the coastal environment in an interesting way. Interactive Games: Invite children to role-play as environmental guardians, where they must clean up the play area of “trash” and plant toy “trees.” This will foster a sense of ownership of the environment. Simple Experiments: Conduct simple experiments such as planting mung bean seeds in cotton wool or soil. This trains fine motor skills and fosters an early understanding of the plant growth process. The second learning material is Disaster Preparedness. Songs and Movements: Create simple songs with lyrics about evacuation steps, such as “if there is an earthquake, hide under the table.” The movements that accompany the song will help children remember it better. Play Simulation: Conduct regular evacuation simulations through play. Invite children to walk in a line to a predetermined meeting point.

This aims to reduce panic and train them to remain calm in emergency situations. Coloring or Drawing: Provide coloring sheets with pictures related to disasters, such as pictures of refugee tents, rescue workers, or evacuation boats. This helps children become familiar with these visuals without fear. The third learning material is the values of mutual cooperation and recycling. “Heroes of Cleanliness” activity: Encourage children to participate in cleaning activities in the school or park environment. Give them stickers or praise as a token of appreciation so they feel proud to be “heroes” who care about the environment. Creations from Used Items: Invite children to make art from recycled materials, such as toy cars from cardboard boxes or flower vases from plastic bottles. This will teach them that trash can have new value and uses. Sorting Trash: Provide trash bins in different colors (for example, green for organic, yellow for inorganic). Give children simple objects and invite them to sort them according to type. This is a practical first step to introduce the concept of recycling.

3.3.3. Learning Methods

The first learning method is through the Scientific Approach. Simple experiments, such as Planting mung bean seeds. Example of Application: Children are invited to observe the growth of the seeds, ask why some grow faster than others, try watering them regularly, and finally conclude that plants need water and sunlight to grow. This process fosters curiosity and logical understanding. For the second learning method, namely Play-Based Learning, interactive games become environmental guardians, evacuation simulations, and “Heroes of Cleanliness” activities. Example of Application: By role-playing, children not only memorize the steps, but also experience and feel the importance of their roles. They learn about cooperation and social responsibility through games. For example, during disaster simulations, they do not feel afraid because they are doing it in a fun atmosphere.

The third learning method is through Project-Based Learning. This method involves children in short- or long-term activities that focus on the final product or outcome. Creating things from used items. Example of Application: Inviting children to make a “Cardboard Car Project” or “Plastic Bottle Flower Vase Project.” Children will be involved from the beginning (gathering materials) to the end (creating the work). This not only trains creativity, but also teaches the value of recycling in a concrete way. For the fourth learning method, namely Collaborative Learning Sorting trash and the “Cleanliness Heroes” activity. Example of Application: Children work in small groups to sort waste. This teaches them how to discuss, listen to their friends' opinions, and share tasks. This is very effective in instilling the values of mutual cooperation and environmental awareness as a team.

3.3.4. Evaluation

The first evaluation method used is Observation (Direct Observation). Points Evaluated: Social skills,

cooperation, initiative, and problem solving. Example of Application: When children conduct an evacuation drill, observe whether they follow instructions calmly, line up orderly, and help their friends. When they clean the play area, note their initiative in picking up trash and how enthusiastic they are in doing so. The second evaluation method is performance Assessment. Points Evaluated: Fine motor skills, creativity, and practical understanding. Example of Application: Evaluation can be done when children make creations from used items. The assessment is not only on the final result (a car made from cardboard), but also on the process whether they are able to cut, glue, and color well. You can also assess how they apply their knowledge of recycling in their work. For the third evaluation, namely Portfolio Assessment. Points Evaluated: Gradual development of skills, creativity, and conceptual understanding. Example of Application: Collect pictures, photos of projects, or notes from green bean experiments made by children. For example, save photos of seed growth from day to day or pictures they made about the coastal environment. This portfolio will be tangible evidence of their learning process and can be shared with parents.

3.3.5. Evaluation

The first evaluation method used is Observation (Direct Observation). Points Evaluated: Social skills, cooperation, initiative, and problem solving. Example of Application: When children conduct an evacuation drill, observe whether they follow instructions calmly, line up orderly, and help their friends. When they clean the play area, note their initiative in picking up trash and how enthusiastic they are in doing so. The second evaluation method is performance Assessment. Points Evaluated: Fine motor skills, creativity, and practical understanding. Example of Application: Evaluation can be done when children make creations from used items. The assessment is not only on the final result (a car made from cardboard), but also on the process whether they are able to cut, glue, and color well. You can also assess how they apply their knowledge of recycling in their work. For the third evaluation, namely Portfolio Assessment. Points Evaluated: Gradual development of skills, creativity, and conceptual understanding. Example of Application: Collect pictures, photos of projects, or notes from green bean experiments made by children. For example, save photos of seed growth from day to day or pictures they made about the coastal environment. This portfolio will be tangible evidence of their learning process and can be shared with parents.

3.4. Implementation

The implementation stage is the stage concerning the feasibility of learning media. At this stage, first, the validity of the curriculum substance is tested by subject matter expert one and subject matter expert two. Second, the validity of the curriculum design and components is tested by subject matter expert one and subject matter expert implementation. Third, the feasibility of the curriculum is validated by Early Childhood Education Teacher One and Early Childhood Education Teacher Two. Fourth, media testing and material validation are conducted by Subject Matter Experts and Early Childhood Education Teachers.

The results of media validation were calculated and analyzed using the Likert scale data analysis technique, yielding the following data:

Table 1. Results of the curriculum substance validity test conducted by subject matter experts

Aspects	Indicator	Value
Validation results Curriculum substanc	Sequence and relevance of material	5
	Appropriateness of philosophy and objectives	5
	Innovation and uniqueness	4
	Local relevance	5
	Depth and breadth of material	5
Number		24
Average		4,8

The table above has an assessment indicator consisting of 1 aspect with 5 assessment items. The score calculation ranges from 1 to 5, with the categories being very poor (1), poor (2), fair (3), good (4), and very good (5). The average curriculum substance validity test score by subject matter experts is 4.8, so the curriculum substance validity test can be calculated as a percentage as follows:

$$\frac{24}{25} \times 100 \% = 96\%$$

So, the above score indicates that the validity test of the curriculum based on subject matter experts is categorized as highly feasible with a score of 96%.

Table 2. Results of the curriculum substance validity test conducted by two subject matter experts

Aspects	Indicator	Value
Validation results Curriculum substanc	Sequence and relevance of material	4
	Appropriateness of philosophy and objectives	5
	Innovation and uniqueness	5
	Local relevance	5
	Depth and breadth of material	5
Number		24
Average		4,8

The table above has an assessment indicator consisting of 1 aspect with 5 assessment items. The score calculation ranges from 1 to 5, with the categories being very poor (1), poor (2), fair (3), good (4), and very good

(5). The average curriculum substance validity test score by two subject matter experts was 4.8, so the curriculum substance validity test can be calculated as a percentage as follows:

$$\frac{24}{25} \times 100 \% = 96 \%$$

So, the above score indicates that the validity test of the curriculum substance based on subject matter expert two is categorized as very feasible with a score of 96%.

Table 3. Results of the validity test of the curriculum design and components conducted by subject matter expert one

Aspects	Indicator	Value
Results of validation of curriculum design and components	Completeness of curriculum components	5
	Language and readability	4
	Flexibility and adaptability	5
Number		14
Average		4,6

The table above shows assessment indicators consisting of 1 aspect with 3 assessment items. The scores range from 1 to 5, with 1 being very poor, 2 being poor, 3 being fair, 4 being good, and 5 being very good. The average Design and Curriculum Component Validity Test conducted by subject matter experts was 4.6, so the Design and Curriculum Component Validity Test can be calculated as follows:

$$\frac{14}{15} \times 100 \% = 93,33 \%$$

So, the above score indicates that the Design Validity Test and curriculum components based on subject matter experts are categorized as highly feasible with a score of 93.33%.

Table 4. Results of the Design Validity Test and Curriculum Components conducted by subject matter experts on implementation

Aspects	Indicator	Value
Results of validation of curriculum design and components	Completeness of curriculum components	5
	Language and readability	5
	Flexibility and adaptability	4
Number		14
Average		4,6

The table above has an assessment indicator consisting of 1 aspect with 3 assessment items. The score calculation ranges from 1 to 5, with the categories being very poor (1), poor (2), fair (3), good (4), and very good (5). The average validity test for the design and curriculum components was conducted by subject matter experts and scored 4.6, so the validity test for the design and curriculum components can be calculated as a percentage as follows:

$$\frac{14}{15} \times 100\% = 93,33\%$$

So, the above score indicates that the Design and Curriculum Component Validity Test based on the implementation material experts was categorized as very feasible with a score of 93.33%.

Table 5. Results of the curriculum implementation validation assessment by one PAUD teacher

Aspects	Indicator	Value
Implementability Validation Results	Practicality and ease of use	5
	Learning effectiveness	4
	Suitability to child characteristics	5
	Benefits and impacts	5
Number		19
Average		4,75

The table above has an assessment indicator consisting of 1 aspect with 4 assessment items. The score calculation ranges from 1 to 5, with the categories being very poor (1), poor (2), fair (3), good (4), and very good (5). The average score for the curriculum implementation validation assessment conducted by PAUD teachers is 4.75, so the curriculum implementation validation assessment can be calculated as follows:

$$\frac{19}{20} \times 100 \% = 95 \%$$

So, the above score indicates that the assessment of curriculum implementation validation by Early Childhood Education Teacher One is categorized as very feasible with a score of 95%.

Table 6. Results of curriculum implementation validation assessment by Early Childhood Education Teacher Two

Aspects	Indicator	Value
Implementability Validation Results	Practicality and ease of use	5
	Learning effectiveness	4
	Suitability to child characteristics	5
	Benefits and impacts	5
Number		19
Average		4,75

The table above shows assessment indicators consisting of 1 aspect with 4 assessment items. The scores range from 1 to 5, with 1 being very poor, 2 being poor, 3 being fair, 4 being good, and 5 being very good. The average score for the Curriculum Implementation Validation assessment conducted by two early childhood teachers was 4.75, so the Curriculum Implementation Validation assessment can be calculated as a percentage as follows:

$$\frac{19}{20} \times 100 \% = 95 \%$$

So, the above score indicates that the assessment of the curriculum's feasibility based on two early childhood teachers is categorized as very feasible with a score of 95%.

Table 7. Results of media testing and material validation conducted by material experts

Aspects	Indicator	Value
	Aspects of assessment suitability	4
	Aspects of assessment practicality	5
Number		9
Average		4,5

The table above has assessment indicators consisting of 1 aspect with 2 assessment items. The score calculation ranges from 1 to 5, with the categories being very poor (1), poor (2), fair (3), good (4), and very good (5). The average score for the media test and material validation conducted by the Material Expert is 4.5, so the media test and material validation can be calculated as a percentage as follows:

$$\frac{9}{10} \times 100 \% = 90 \%$$

So the above scores indicate that the media test and material validation by subject matter experts were categorized as highly feasible with a score of 90%.

Table 8. Results of the media test and material validation conducted by early childhood Teachers

Aspects	Indicator	Value
Benefits and impact Validation results of assessment aspects	Aspects of assessment suitability	5
	Aspects of assessment practicality	4
Number		9
Average		4,5

The table above has an assessment indicator consisting of 1 aspect with 2 assessment items. The score calculation ranges from 1 to 5, with the categories being very poor (1), poor (2), fair (3), good (4), and very good (5). The average score for the media test and material validation conducted by PAUD teachers is 4.5, so the media test and material validation can be calculated as follows:

$$\frac{9}{10} \times 100 \% = 90 \%$$

So, the above score indicates that the media test and material validation based on PAUD teachers are categorized as very feasible with a score of 90% .

Thus, the eight validation assessments are above 93.58% . This score is in the very feasible category. Therefore, the media for the Development of an Early Childhood Education Curriculum Based on Greening Adaptation for Environmental Resilience as a whole obtained a score of 93.58% and is in the very feasible category.

3.5.Evaluation

The Evaluation stage is a stage that must be improved in product development, such as in the development of a PAUD curriculum based on adaptation to greening for coastal environmental resilience. What components need to be improved so that it becomes a meaningful, effective, and efficient PAUD curriculum based on adaptation to greening for coastal environmental resilience? The PAUD curriculum media based on Greening Adaptation for Coastal Environmental Resilience was concluded to be feasible with revisions because the average validation by subject matter experts, implementation experts, and PAUD teachers obtained a score of 93.58%. Criticism and suggestions were received, namely to add class outings to the beach. The validation results concluded that the implementation of the Early Childhood Education Curriculum Based on Greening Adaptation for Coastal Environmental Resilience is feasible for use. This is supported by previous research findings that independent curricula encourage inclusivity and local adaptation in early childhood education.

4. Discussion

This study aims to make the learning process meaningful, effective, and efficient, as well as to instill values of awareness and preparedness for disasters from an early age so that children can grow into resilient individuals who can contribute to mitigation and adaptation efforts in the future. This study follows the ADDIE model, which consists of five stages: analysis, design, development, implementation, and evaluation. This study successfully identified that the Early Childhood Education Curriculum Based on Greening Adaptation for Coastal Environmental Resilience is valid and suitable for use as a medium of information for a meaningful, effective, and efficient learning process, as well as instilling values of awareness and preparedness for disasters from an early age so that children can grow into resilient individuals and contribute to mitigation and adaptation efforts in the future.

This Early Childhood Education Curriculum Based on Greening Adaptation for Coastal Environmental Resilience provides a design for Curriculum Objectives, Learning Materials, Learning Methods, and Evaluation. In addition, the objective of developing this Early Childhood Education Curriculum Based on Greening Adaptation for Coastal Environmental Resilience is to assess its effectiveness as an information tool for meaningful, effective, and efficient learning processes, as well as to instill values of awareness and preparedness for Disasters from an early age so that children can grow into resilient individuals who can contribute to mitigation and adaptation efforts in the future. The Early Childhood Education Curriculum Based on Greening Adaptation for Coastal Environmental Resilience is a valuable educational tool in the learning process. It provides a design that includes Curriculum Objectives, Learning Materials, Learning Methods, and Evaluation. In addition, it is presented based on everyday life so that it is easy for teachers and principals to understand.

(Waluyo et al., 2021) emphasizes the importance of systematic curriculum management. Their research shows that good management can create effective work steps in designing, organizing, implementing, and evaluating the curriculum, thereby contributing positively to the quality of education. In addition, the role of teachers in this regard is crucial. Based on the research (Sulchaniya and Waluyo, 2024) Development and Implementation of Independent Curriculum in “Pengerak” Kindergarten: A Case Study of Semarang City, this study confirms that Independent Curriculum encourages inclusiveness and local adaptation in early childhood education.

However, to obtain a more comprehensive picture, future research needs to be conducted with a longer observation period and broader geographical coverage to evaluate the long-term impact of the curriculum and explore more innovative curriculum design strategies. Given these advantages, researchers chose to develop this product, given the limited number of studies focusing on the Green Adaptation-Based Early Childhood Education Curriculum for Coastal Environmental Resilience as a medium of information for meaningful, effective, and efficient learning processes and instilling values of awareness and preparedness for disasters from an early age so that children can grow into resilient individuals and contribute to mitigation and adaptation efforts in the future. Furthermore, the Early Childhood Education Curriculum Based on Greening Adaptation for Coastal Environmental Resilience contains information about the early childhood education curriculum that can increase the knowledge of principals and teachers while strengthening the theory of meaningful, effective, and efficient learning.

(Yunita & Suryana, 2022) emphasize that the development of an early childhood education curriculum is a crucial foundation for ensuring that education programs are relevant and effective. During the development stage, the early childhood education curriculum underwent a validation process. The results of the validity test of the curriculum based on subject matter experts were categorized as very feasible with a score of 96%, which stated that this early childhood education curriculum was valid and feasible for implementation. The results of the validity test of the curriculum based on subject matter experts were categorized as very feasible with a score of 96%, which stated that this early childhood education curriculum was valid and feasible for implementation. The validation of the Design and Curriculum Component Validity Test based on subject matter expert one is categorized as highly feasible with a score of 93.33%, indicating that this Early Childhood Education Curriculum is valid and feasible for implementation.

Validation of the Design and Curriculum Component Validity Test based on subject matter experts categorized it as highly feasible with a score of 93.33%, stating that this early childhood education curriculum is valid and feasible for implementation. Validation of the Curriculum Implementation based on Early Childhood Education Teachers was categorized as highly feasible with a score of 95%, indicating that this Early Childhood Education Curriculum is valid and feasible for implementation. The validation of the curriculum implementation based on two early childhood education teachers was categorized as very feasible with a score of 95%, which indicates that this early childhood education curriculum is valid and feasible for implementation. Validation of media testing and material validation based on material experts was categorized as very feasible with a score of 90%, stating that this early childhood education curriculum is valid and feasible for implementation. Validation of media testing and material validation based on early childhood education teachers was categorized as very feasible with a score of 90%, stating that this early childhood education curriculum is valid and feasible for implementation. A similar study entitled “Development Of Early Childhood Education Curriculum” shows that curriculum plays a central role in ensuring the success of early childhood education. A well-designed curriculum can provide positive stimulation for children's development, including spiritual aspects that prepare them for further education (Hamidi et al., 2024). The findings of this study highlight the importance of an early childhood education curriculum that is an effective and easily accessible educational tool for meaningful, effective, and efficient learning, as well as instilling values of awareness and preparedness for disasters from an early age so that children can grow into resilient individuals who can contribute to mitigation and adaptation efforts in the future. By providing a curriculum design, learning materials, learning methods, and evaluation. Early Childhood Education Curriculum Based on Greening Adaptation for Coastal Environmental Resilience serves as a practical reference for principals and teachers in identifying early childhood education curricula.

The results of the study show that the Early Childhood Education Curriculum Based on Greening Adaptation for Coastal Environmental Resilience not only enhances meaningful, effective, and efficient learning but also instills values of awareness and preparedness for disasters from an early age so that children can grow into resilient individuals who contribute to mitigation and adaptation efforts in the future. Furthermore, successful

validation and positive feedback from respondents indicate that this medium can be adopted on a wider scale, such as in teacher training programs and early childhood education curricula. The structured nature of the Early Childhood Education Curriculum Based on Greening Adaptation for Coastal Environmental Resilience is also in line with current education policies on early childhood education curriculum development, which strengthens its relevance for long-term implementation in early childhood education institutions. Although effective, this study has several limitations. The implementation phase was conducted in a relatively short period of time, limiting the ability to observe long-term behavioral changes in children resulting from the use of the Early Childhood Education Curriculum Based on Adaptive Greening for Coastal Environmental Resilience.

Further research should consider adding class outings to the beach to measure the sustainable impact of the Early Childhood Education Curriculum Based on Greening Adaptation for Coastal Environmental Resilience on meaningful, effective, and efficient learning, as well as instilling values of awareness and preparedness for disasters from an early age so that children can grow into resilient individuals who can contribute to mitigation and adaptation efforts in the future. Finally, collaboration with early childhood education institutions and education policymakers can increase the scalability of the program, ensuring that this handbook reaches a wider audience and becomes a standard resource in early childhood education initiatives.

5. Conclusion

This study concludes that the Early Childhood Education Curriculum Based on Greening Adaptation for Coastal Environmental Resilience is a valid, feasible, and effective educational tool for use in early childhood education. This study aims to create meaningful, effective, and efficient learning, while instilling values of environmental awareness and disaster preparedness from an early age. Children are expected to grow into resilient individuals who can contribute to mitigation and adaptation efforts in the future. This study uses the ADDIE development model, ensuring a systematic process from analysis to evaluation. This curriculum has been tested and proven to be highly feasible. Based on various validity tests of substance, design, and feasibility, this curriculum received high scores (90%-96%), confirming that it is valid and feasible for implementation.

This curriculum has successfully identified that it is a valuable medium of information for achieving the specified learning objectives. In addition, this curriculum not only improves meaningful and efficient learning processes, but also successfully instills important values. By providing a comprehensive design, covering Curriculum Objectives, Learning Materials, Learning Methods, and Evaluation, this curriculum serves as a practical reference for teachers and principals. Its structured nature and presentation based on everyday life make it easy to understand and in line with current education policies. Although effective, this study has limitations due to the short implementation period. This limits the ability to observe long-term impacts. Therefore, future research is recommended to be conducted over a longer period and with broader geographical coverage. In addition, collaboration with early childhood education institutions and policymakers can increase the scalability of the program, ensuring that this curriculum becomes a standard resource in early childhood education initiatives.

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