

Harmonizing Ethnomathematics-Based Green Behavior Integrated With *Nangun Sat Kerthi Loka* Bali Values in Education

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ABSTRACT

The growing environmental degradation underscores the role of education in fostering green behavior among students. This study aims to explore the relationships among *Nangun Sat Kerthi Loka* Bali, green behavior, and Ethnomathematics, and to identify the role of Ethnomathematics in strengthening the development of green behavior in educational settings. This research employed a qualitative, phenomenological approach in four Adiwiyata Mandiri schools in Singaraja, Bali: SD N 1 Banyuning, SMP N 2 Singaraja, SMP N 6 Singaraja, and SMP N 3 Seririt, selected through purposive sampling. The study involved 12 informants, including representatives from the Department of Education, the Environmental Agency, and the Cultural Agency, as well as teachers and students. Data were collected through a literature review, in-depth interviews, and observations, and were analyzed using descriptive qualitative content analysis through the stages of data reduction, categorization, interpretation, and source triangulation. The findings reveal an integrative relationship among *Sad Kerthi* values, the six dimensions of green behavior, and Ethnomathematical activities embedded in school environmental practices. Ethnomathematics helps integrate environmental activities with mathematical concepts, thereby strengthening the development of meaningful green behavior. These findings indicate that integrating local wisdom values and Ethnomathematics can reinforce sustainable character education in schools.

Keywords: *nangun sat kerthi loka bali, green behavior, ethnomathematics, character education*

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INTRODUCTION

Environmental awareness is key to ensuring sustainability and quality of life in the future. This principle aligns with the 8th Asta Cita, which emphasizes living in harmony with nature and culture (Rahawarin & Selanno, 2026). This commitment is also reflected in various government policies aimed at strengthening the foundations of environmental sustainability (Sudaryono & Kartika, 2022). However, the implementation of these policies has not yet been fully optimized, as evidenced by the still-high rates of environmental damage (Nasution & Kahpi, 2025). In recent years, Indonesia has faced increasingly complex environmental challenges, marked by environmental pollution, reliance on non-environmentally friendly energy sources, and a rise in natural disasters (Nasution & Kahpi, 2025). These conditions highlight the urgency of addressing environmental issues and indicate a gap between policy formulation and its implementation.

This phenomenon occurs not merely at the national level but is also increasingly evident at the regional level, including in Bali Province. One notable example is flooding in several areas of Bali, which has caused environmental damage and disrupted community activities. This situation indicates that Bali, long recognized for its strong local wisdom in maintaining harmony with nature, is facing significant challenges

in implementing these values. Bali has a philosophical foundation rooted in local wisdom, articulated in the vision of *Nangun Sat Kerthi Loka Bali*, which aims to guide development in a fundamental and comprehensive manner, encompassing nature, *Krama* (people), and Balinese culture (Prasada et al., 2024). This vision is rooted in the values of *Tri Hita Karana*, derived from the local wisdom of *Sad Kerthi*, which are deeply embedded in Balinese society and emphasize harmony within Bali's natural environment and its elements (Mahendra, 2021). In addition, *Nangun Sat Kerthi Loka Bali*'s vision offers an alternative approach to strengthening character education grounded in local wisdom (Mahendra, 2021). However, in practice, these values have not been fully internalized in people's behavior, resulting in ongoing environmental issues. Therefore, the conceptual strength of this vision needs to be supported by more effective implementation.

Given the increasingly urgent environmental problems, long-term solutions are needed through the development of environmental awareness, including strengthening Green Behavior. Green Behavior refers to actions that reflect concern for the environment in daily life (Nurfarida et al., 2021). Instilling this character from an early age is essential for developing sustainable habits, particularly through education in schools (Azis et al., 2022; Sudaryono & Kartika, 2022). Schools play a strategic role as agents of change in fostering ecological awareness through environment-based education (Ginting, 2024), including through the implementation of environmentally friendly schools that integrate sustainability values into learning (Romadhon et al., 2024). Furthermore, character development needs to be integrated with local wisdom values to make it more contextual and meaningful, particularly those that emphasize harmonious relationships between humans and the environment through habituation in contextual activities (Antara et al., 2025; Hartayani & Wulandari, 2022; Putri et al., 2024).

The development of Green Behavior in environmentally friendly schools involves various activities such as waste management, compost production, greening initiatives, energy conservation, and the utilization of the environment as a learning resource to promote sustainable behavior (Sudaryono & Kartika, 2022). In addition to being closely related to cultural practices in daily life, the development of Green Behavior contains rich learning potential, particularly in the form of contextual mathematics learning (Sulfayanti et al., 2022). The integration of culture and mathematics is known as Ethnomathematics, which can create contextual learning and support character development (Naja et al., 2022). Research by Sulfayanti et al. (2022) highlight that Ethnomathematics plays a pivotal role in character education, including in the development of Green Behavior. In practice, activities such as garden arrangement, waste management, irrigation planning, and land utilization inherently involve mathematical concepts such as measurement, patterns, comparison, and optimization, while considering aspects of order and aesthetics (Jusmawati & Nurmala, 2025). This is in line with findings that various cultural practices and daily activities embody mathematical concepts that can be utilized as meaningful learning resources (Rosady et al., 2024; Tamariska et al., 2024). However, it is still found that the relationship between environmental activities and mathematical concepts has not been systematically integrated into learning in several schools. In fact, the application of Ethnomathematics in Green Behavior activities can enhance students' understanding of mathematical concepts while supporting more structured planning that takes aesthetic aspects into account (Sunantara et al., 2024; Widiarta et al., 2024).

Several previous studies have examined related topics, but they still have limitations. The study by Mahendra, (2021) successfully identified the character education embedded in the vision of *Nangun Sat Kerthi Loka Bali*. However, this study has not yet examined Green Behavior in greater depth. Research by Oktamarina (2021) found that green school activities can enhance students' environmental awareness and character. Nevertheless, the study did not examine its relationship with Ethnomathematics and the vision of *Nangun Sat Kerthi Loka Bali* in supporting *Asta Cita*. Furthermore, the research results of Santika et al. (2022) provide new insights into the relationship between science and the development of environmentally conscious character in students. However, that did not address the mathematical aspects inherent to it. Thus, previous studies tend to discuss the values of *Nangun Sat Kerthi Loka Bali*, Green Behavior, and

Ethnomathematics separately, resulting in a lack of a comprehensive explanation of the relationship among these three aspects in the educational context.

Based on the discussion above, no study has been found that specifically examines the interrelationships among *Nangun Sat Kerthi Loka Bali* values, Green Behavior, and Ethnomathematics in the context of environmental education in Adiwiyata schools. Therefore, this study explores the relationship among *Nangun Sat Kerthi Loka Bali*, Green Behavior, and Ethnomathematics, and identifies the role of Ethnomathematics in strengthening the development of Green Behavior grounded in Balinese local wisdom. The research findings are expected to serve as a reference for strengthening culturally grounded, Ethnomathematics-based character education and to provide practical guidance for schools in fostering sustainable, environmentally responsible behavior.

LITERATURE REVIEW

Previous Studies

Previous studies indicate that culture and environment-based education plays an essential role in developing students' environmental care character. Mahendra (2021) emphasizes the character education values embedded in the *Nangun Sat Kerthi Loka Bali* vision, while Oktamarina (2021) states that green school activities can improve students' character in environmental care. In addition, Santika et al. (2022) reveal a relationship between science learning and the development of environmental care character. However, these studies still tend to examine cultural, environmental, and learning aspects separately. Research on the relationship among the *Nangun Sat Kerthi Loka Bali* vision, Green Behavior, and Ethnomathematics within the context of environmental education remains limited.

The Vision of Nangun Sat Kerthi Loka Bali

The *Nangun Sat Kerthi Loka Bali* vision serves as the foundation for Bali's development, emphasizing a balanced relationship among nature, *Krama* (people), and culture Prasada et al. (2024). Mahendra (2021), explains that this vision not only serves as a regional development direction but also helps strengthen character education grounded in local wisdom. This is consistent with Oktamarina, (2021), who highlights that environmental education can foster environmental care character through the habituation of sustainable behaviors in schools. Meanwhile, Rahawarin and Selanno (2026) indicate that environmental sustainability values are essential in supporting sustainable development goals through Asta Cita. Based on these studies, the *Nangun Sat Kerthi Loka Bali* vision is closely related to the development of Green Behavior, as both emphasize harmony between humans and the environment. However, this relationship has not been widely examined in the context of local wisdom-based education in schools.

Ethnomathematics-Based Green Behavior

Green behavior refers to actions that reflect awareness and responsibility toward environmental sustainability (Nurfarida et al., 2021). Sudaryono and Kartika (2022) emphasize that such behavior should be developed through environmental education and habituation in schools. Similarly, Oktamarina (2021) underlines that green school activities can foster environmental care character, while Santika et al. (2022) associate science learning with strengthening this character. However, these studies have mainly highlighted behavioral and scientific aspects, while the mathematical concepts embedded in environmental care activities have received limited attention. In fact, activities such as waste management, greening programs, and environmental arrangement involve contextual mathematical concepts such as measurement, patterns, and order. Putra and Prasetyo (2022) explain that Ethnomathematics can integrate culture and mathematics into more meaningful learning. Therefore, Ethnomathematics-based Green Behavior has the potential to strengthen environmental care character while supporting mathematics learning grounded in culture and students' everyday experiences.

METHOD

This study employed a qualitative, phenomenological approach to examine real-world conditions occurring naturally in the field. The research was conducted in Adiwiyata Mandiri award-winning schools in Singaraja, Bali, namely SD N 1 Banyuning, SMP N 2 Singaraja, SMP N 6 Singaraja, and SMP N 3 Seririt, which have systematically implemented environmental care programs. The research sites were selected using purposive sampling. Data sources were obtained through exploration of values related to the *Nangun Sat Kerthi Loka Bali* vision, Green Behavior, and Ethnomathematics, as implemented in several Adiwiyata schools in Singaraja, Bali, with a focus on environmentally friendly school practices. The study involved 12 informants, including one representative from the Bali Provincial Cultural Office, two representatives from the Buleleng Regency Education Office, one representative from the Buleleng Regency Environmental Office, four teachers, three students from Adiwiyata Mandiri schools, and one Ethnomathematics expert. The informants were selected through purposive sampling based on their involvement and understanding of the implementation of the *Nangun Sat Kerthi Loka Bali* vision, the development of Green Behavior, and Ethnomathematical activities embedded in environmental care practices at schools.

Variables and Achievement Indicators

The variables and achievement indicators are presented in Table 2.

Table 1. Variables and Achievement Indicators

Variable / Research Focuses	Achievement Indicators
The Vision of <i>Nangun Sat Kerthi Loka Bali</i>	<i>Sad Kerthi's</i> values are reflected in the development of Green Behavior in schools.
Green Behavior	Demonstrated through attitudes, participation, and environmentally responsible habits within the school environment.
Ethnomathematics	Culture-based mathematical activities are implemented in environmentally friendly practices.
Interrelationship	The relationships among variables are identified, leading to the formulation of an ethnomathematics-based concept for Green Behavior education to strengthen the vision.

Research Stages

The research stages consist of preparation, data collection, data analysis, and results, as illustrated below.

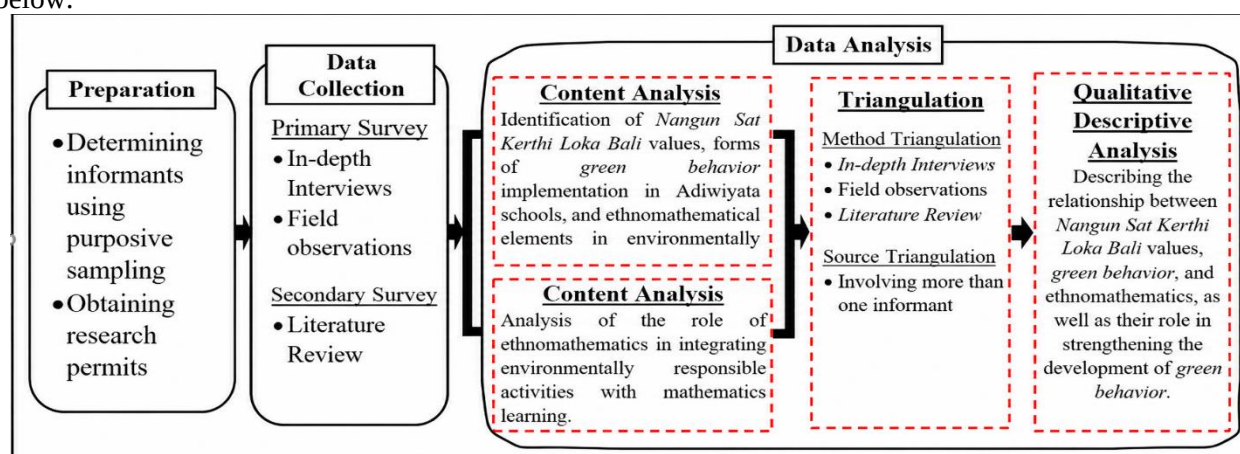


Figure 1. Research Stages

Data Sources and Data Collection Techniques

The data sources and data collection techniques used in this study are detailed in Table 3.

Table 2. Data Sources and Data Collection Techniques

Research Focuses	Data Collections	Instruments	Sources
The Vision of <i>Nangun Sat Kerthi Loka Bali</i> , <i>Green Behavior</i> , and Ethnomathematics	Literature Review	Research articles/journals	-
	In-depth Interviews	Interview guidelines	
	Participant Observation	Observation sheet	Adiwiyata Mandiri schools

Data Analysis Techniques

The data analysis technique in this study employed content analysis using a qualitative descriptive approach. Content analysis was applied to examine the meanings and values derived from the literature review, in-depth interviews, and observations related to the *Nangun Sat Kerthi Loka Bali* vision, Green Behavior, and Ethnomathematics. The analysis process was conducted systematically through several stages, including data reduction, open coding, theme categorization, interpretation, and descriptive presentation. During the data reduction stage, information obtained from interviews, observations, and literature studies was selected and focused in accordance with the research objectives. Furthermore, open coding was conducted by assigning codes to the data based on the main themes related to the *Nangun Sat Kerthi Loka Bali* vision, the dimensions of Green Behavior, and Ethnomathematical activities. The coded data were hence categorized to identify patterns of relationships among the variables. The interpretation stage was conducted to explain the relationships among the *Nangun Sat Kerthi Loka Bali* vision, Green Behavior, and Ethnomathematics in the context of environmental education. The results were subsequently presented descriptively to provide an overview of ethnomathematics' role in strengthening the development of Green Behavior grounded in local wisdom.

Conclusion of Research Findings

Research conclusions were drawn through a qualitative descriptive process that involved interpreting and triangulating data from the literature review, in-depth interviews, and observations. The findings were drawn from method and source triangulation to ensure the trustworthiness of the results. Method triangulation was conducted by comparing data from observations, in-depth interviews, and a literature review, while source triangulation was carried out by involving multiple informants. The synthesized results were subsequently used to confirm the relationships among *Nangun Sat Kerthi Loka Bali* values, the dimensions of Green Behavior, and Ethnomathematics, and to identify the role of Ethnomathematics in strengthening the development of Green Behavior in the context of environmental education.

RESULTS AND DISCUSSION

Results

Exploration Results of *Nangun Sat Kerthi Loka Bali*

The literature review reveals various studies on *Nangun Sat Kerthi Loka Bali*. Several key findings from the literature are summarized as follows.

Table 3. Literature Review on *Nangun Sat Kerthi Loka Bali*

Sources	Findings
Mahendra, (2021)	The vision of <i>Nangun Sat Kerthi Loka Bali</i> reflects the Governor of Bali's approach to guiding regional development and offers an alternative to character education grounded in local wisdom.
Prasada et al. (2024)	The vision of <i>Nangun Sat Kerthi Loka Bali</i> is directed toward the "New Era of Bali,"

Wijaya et al. (2023)	emphasizing comprehensive development grounded in the local wisdom of <i>Sad Kerthi</i> . Development in Bali Province is guided by the principles of <i>Nangun Sat Kerthi Loka Bali</i> , which balance the aspects of nature, <i>Krama</i> (people), and Balinese culture.
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Based on Table 3, the vision of *Nangun Sat Kerthi Loka Bali* is rooted in the values of *Sad Kerthi*, which emphasize the balance among nature, *Krama* (people), and culture as the main direction of development in Bali.

The interview results with the Department of Education and the Environmental Agency of Buleleng Regency indicate that the vision of *Nangun Sat Kerthi Loka Bali* serves as a primary guideline in various educational and environmental programs. Furthermore, an interview with the Bali Provincial Department of Culture reveals the following: “*The vision of Nangun Sat Kerthi Loka Bali is rooted in the values of Sad Kerthi. Based on its constituent terms, ‘nangun’ means to build or preserve, ‘sat’ refers to goodness or purity, ‘kerthi’ denotes prosperity, sustainability, or well-being, and ‘loka’ means the universe or environment. Thus, this vision represents efforts to preserve, develop, and maintain the purity and nobility of Bali through the values of Sad Kerthi in order to achieve well-being, harmony, and happiness, both physically (Sekala) and spiritually (Niskala).*”

Based on the literature review and interviews, the vision of *Nangun Sat Kerthi Loka Bali* emphasizes the balance between nature, *Krama* (people), and culture as the primary direction of development in Bali. These values serve as the foundation for character formation and policy development. The vision is rooted in the concept of *Sad Kerthi*, which functions as the main foundation for implementing local wisdom values to achieve well-being, harmony, and happiness in both the *Sekala* (physical) and *Niskala* (spiritual) dimensions. The values of *Sad Kerthi* comprise six components, as follows:

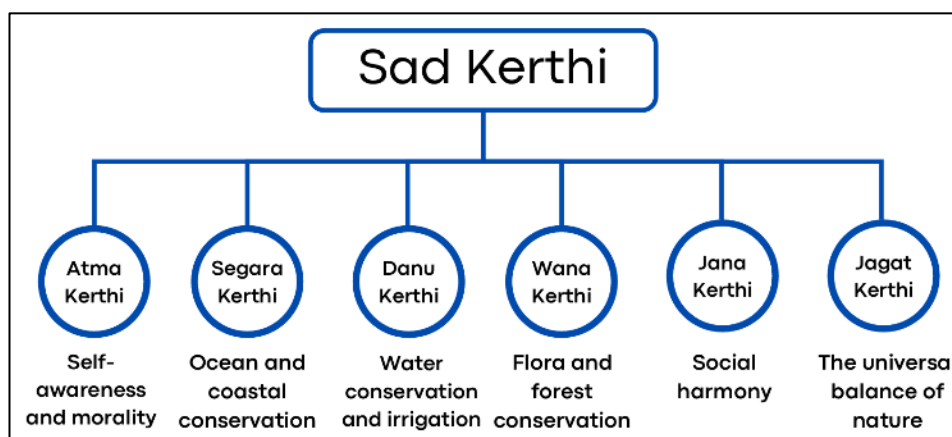


Figure 2. Components of *Sad Kerthi*

This vision aligns with *Asta Cita*, initiated by the President of the Republic of Indonesia, particularly the eighth point concerning environmental sustainability. The values of *Sad Kerthi* reinforce its implementation, as both emphasize the balance between humans, nature, and culture in sustainable development.

Exploration Results of Green Behavior in Adiwiyata Schools

The literature review identified various studies related to *green behavior*. Several key findings are summarized as follows.

Table 4. Literature Review on Green Behavior in Educational Institutions

Sources	Findings
Nurfarida et al. (2021)	Green Behavior is reflected in awareness, concern, and responsibility toward environmental sustainability, for example, through maintaining environmental cleanliness, disposing of waste properly, and conserving electricity.
Wandari dan Darma (2021)	The development of Green Behavior through early-age character education fosters strong environmental awareness and concern.
Romadhon et al. (2024)	Learning integrated with Green Behavior encourages students to develop environmentally responsible attitudes, including caring for the environment and managing waste.

Based on Table 4, Green Behavior develops through educational processes that instill environmental awareness and responsibility in a sustainable manner. Early habituation is essential to ensure that environmentally responsible behavior becomes part of students' character and lifestyle.

The interview results with the Department of Education, the Environmental Agency, teachers, and students indicate that the development of Green Behavior is essential and should be instilled from an early age through school-based education. An interview with the Department of Education of Buleleng further reveals that: *"The development of environmentally responsible character must be habituated through education in schools. One of the efforts that has been implemented is the Adiwiyata school program, which is a collaborative initiative with the Environmental Agency."* A similar perspective was expressed by the Environmental Agency of Buleleng: *"It is challenging to shift habits from the old paradigm (collect-dispose) to a new paradigm (sort-process) through concrete actions. Therefore, education and habituation need to be emphasized. The implementation of Adiwiyata Schools is expected to foster environmentally responsible character among students."* As such, further exploration was conducted in public schools in Singaraja, Bali, that have received the Adiwiyata Mandiri award. Several schools that achieved this highest recognition in 2025, predominantly from Buleleng, include SMP N 3 Seririt, SMP N 6 Singaraja, SMP N 2 Singaraja, and SD N 1 Banyuning.

The results of interviews with several teachers from Adiwiyata-awarded schools indicate that habituation is the key to successful implementation. Each school develops different approaches based on students' characteristics and the environmental potential of their surroundings. A teacher from SMP Negeri 6 Singaraja explained: *"Before implementing the program, we identify the environmental potentials and issues around the school, so that we can determine priority activities."* A teacher from SMP Negeri 2 Singaraja emphasized the importance of collective involvement: *"The Adiwiyata program cannot be implemented by only a few individuals. All teachers, students, and staff must be involved so that a culture of environmental awareness can truly be embedded in the school."* A teacher from SMP Negeri 3 Seririt stated: *"We have Adiwiyata student cadres who are responsible for maintaining cleanliness, monitoring waste sorting, and reminding their peers to conserve energy."* Meanwhile, the principal of SD Negeri 1 Banyuning added: *"We start from simple habits, such as bringing reusable water bottles and not littering. From these small practices, students learn responsibility."*

As described above, Adiwiyata schools adopt diverse approaches in developing environmental programs according to their respective potentials. This variation indicates that the Adiwiyata program is not uniform, but rather adaptable to the specific conditions and characteristics of each school. Furthermore, schools that have achieved the Adiwiyata Mandiri status serve as mentor schools, supporting other schools in implementing sustainable environmental programs to broaden their positive impact.

Based on interviews with teachers and students, as well as observational data, Adiwiyata schools implement a range of environmentally friendly innovations. The implementation and programs carried out are as follows.



Figure 3. Environmental Sustainability Practices in Adiwiyata Schools

Based on interview and observation results, Adiwiyata schools similarly strive to foster green behavior within the educational environment, though to varying degrees. From these findings, six dimensions of Green Behavior formation are identified, as follows.

Table 5. Six Dimensions of Green Behavior Formation

Dimensions of Green Behavior Formations	Descriptions
Drainage, sanitation, and environmental cleanliness	This aspect encompasses water management systems, sanitation facilities, and overall environmental cleanliness within the school, aiming to create a healthy, safe, and comfortable learning environment.
Waste management	This aspect focuses on the processes of waste collection, sorting, processing, and recycling to reduce environmental pollution and promote a zero-waste culture.
Plant maintenance	This aspect emphasizes activities such as planting, nurturing, and maintaining vegetation as a form of environmental preservation.
Water conservation	This aspect focuses on the management of water resources through efficient usage, rainwater infiltration, and sustainable water utilization.
Energy conservation (electricity)	This aspect highlights efficient energy use and the use of renewable energy sources, particularly electricity.
PRLH innovation	This aspect encompasses the creativity and innovation of school members in fostering sustainable living habits through behaviors and activities, as well as in developing environmentally friendly products.

Results of the Ethnomathematics Study

The literature review identified various studies related to Ethnomathematics. Several key findings are summarized as follows.

Table 6. Literature Review on Ethnomathematics

Sources	Findings
Putra dan Prasetyo (2022)	Ethnomathematics helps link basic mathematical concepts to local culture, thereby enhancing students' understanding of mathematics through culturally embedded contexts.
Bimantara (2024)	The integration of ethnomathematics into mathematics learning enriches mathematical contexts with local culture, increases students' motivation, and makes mathematical concepts more meaningful for learners.
Siregar et al. (2024)	Mathematical concepts can be integrated with local culture through ethnomathematics to

strengthen students' understanding and make learning more relevant to everyday life contexts.

As shown in Table 7, Ethnomathematics represents the intersection between mathematics and culture as reflected in community activities, where basic mathematical concepts and ideas are unconsciously applied in daily life.

The interview results with two mathematics experts provide a general understanding that mathematics can be found in everyday cultural practices, often without our awareness. The results of interviews with experts in the field of mathematics indicate that *“mathematical and cultural concepts are integrated components of daily life, as culture represents a unified and holistic system within society. Ethnomathematics is viewed as an approach that connects mathematics with culture in everyday life.”* Various community activities, such as counting, measuring, and pattern-making, reflect mathematical practices naturally embedded in daily life. This is consistent with Bishop's Mathematical Activities framework, which positions mathematics as a contextual and meaningful human activity. In line with these findings, observations conducted in Adiwiyata schools reveal practices that incorporate mathematical concepts into implemented programs.

Thus, the research results indicate that mathematics and culture are closely interconnected, as reflected in community activities that align with Bishop's Mathematical Activities, which include counting, locating, measuring, designing, playing, and explaining. These activities provide an essential foundation for integrating cultural values into the process of mathematics learning.

The Relationship between the Nangun Sat Kerthi Loka Bali Vision, Green Behavior, and Ethnomathematics

The relationship between the *Sad Kerthi* values embedded in the *Nangun Sat Kerthi Loka Bali* vision, the development of Green Behavior, and the application of Ethnomathematics in environmental activities can be illustrated as follows.

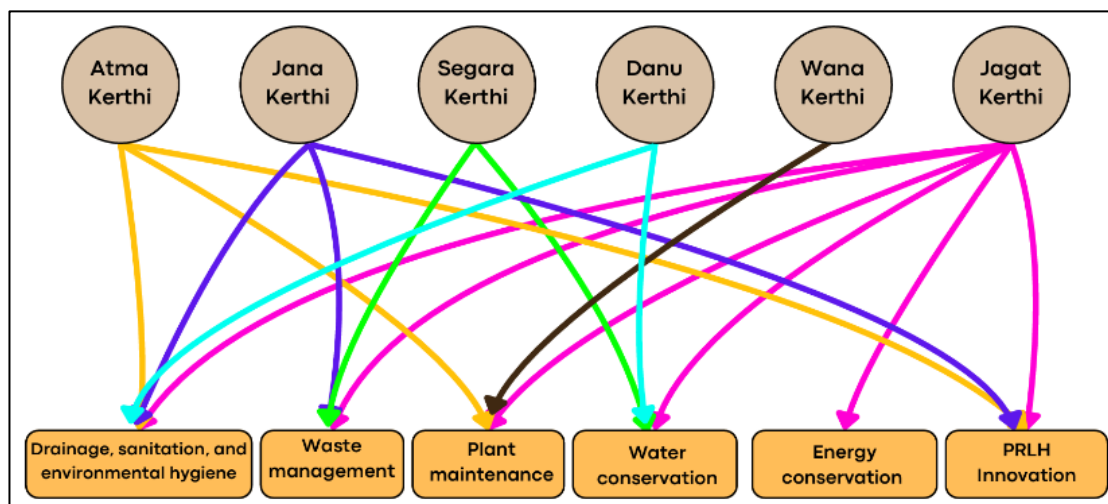


Figure 4. The Relationship between *Sad Kerthi* and Green Behavior

As shown in Figure 4, each value within *Sad Kerthi* is closely related to the six dimensions of Green Behavior, ranging from drainage, sanitation, and environmental cleanliness to innovations in environmentally friendly behavior. This relationship indicates that the *Nangun Sat Kerthi Loka Bali* vision, which is rooted in the local wisdom values of *Sad Kerthi*, serves as a foundation for fostering environmentally responsible

behavior in schools.

	Drainage, Sanitation, and Environmental Hygiene	Waste Management	Plant Maintenance	Water Conservation	Energy Conservation	PRLH Innovation
Counting		✓	✓			
Measuring	✓		✓	✓	✓	
Playing						✓
Designing	✓	✓	✓		✓	✓
Locating	✓		✓	✓		
Explaining	✓	✓	✓	✓	✓	✓

Figure 5. The Relationship between Green Behavior and Ethnomathematics

Furthermore, Figure 5 illustrates how elements of ethnomathematics, such as counting, measuring, playing, designing, locating, and explaining, are integrated into various environmental activities in the school context. This finding demonstrates that ethnomathematics not only enriches the learning process but also strengthens the implementation of *Nangun Sat Kerthi Loka Bali* values through the practical enactment of Green Behavior rooted in local culture.

Optimizing Green Behavior through the Integration of Mathematical Concepts

Strengthening Green Behavior in the school environment requires careful, measurable planning and cannot be implemented arbitrarily. Activities such as waste management, garden arrangement, and energy utilization require precise calculations to ensure effectiveness and sustainability. Without proper measurement and mathematical calculation, these activities may not be optimal, leading to issues such as inadequate storage capacity, disorganized layouts, imbalanced material composition, and inefficient facility placement, ultimately reducing both the functional and aesthetic value of the environment. In this context, mathematical concepts play a fundamental role in determining optimal size, distance, proportion, and positioning. The following are examples of the application of mathematical concepts in school environmental management, as illustrated in the figures, including the design of *Teba Modern*, garden arrangement, the production of liquid organic fertilizer, and the placement of solar panels.

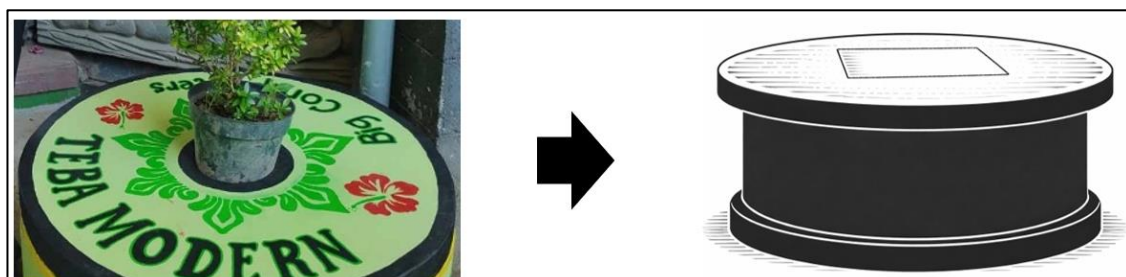


Figure 6. Mathematical Visualization in *Teba Modern*

Teba Modern is designed in a cylindrical shape to optimize storage capacity while ensuring efficient land use. In its construction, factors such as height, diameter, and ease of processing organic materials are

considered. Generally, *Teba Modern* is approximately 5 meters tall. Using the concept of the volume of a cylinder, the capacity can be calculated using the formula: $V = \pi r^2 t$. For example, with a radius of 1 meter and a height of 5 meters, the volume is $5\pi \approx 15,7 m^3$ or approximately 15,700 liters. This calculation serves as the basis for determining the appropriate size of the *Teba* according to specific needs.

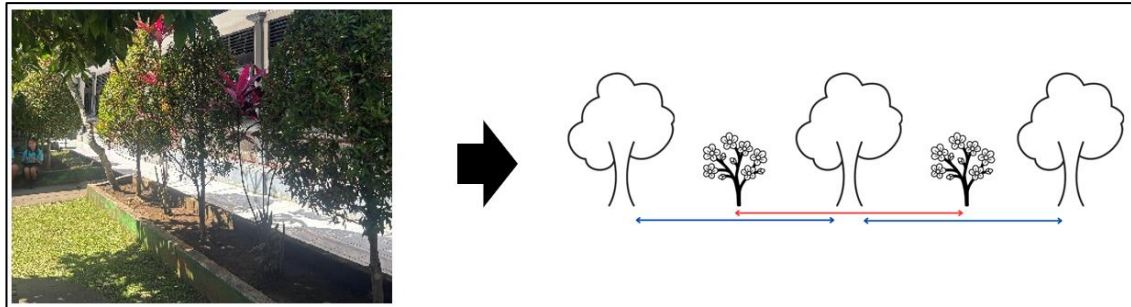


Figure 7. Mathematical Concepts in Plant Arrangement

Garden arrangement is carried out by maintaining equal spacing between plants to create a neat appearance and support optimal growth. This pattern follows an arithmetic sequence, in which the difference between plant positions remains constant, for example, 0 m, 1 m, 2 m, and so on. The determination of spacing takes into account the type of plants, land area, and ease of maintenance. With a regular pattern, the distribution of sunlight and water becomes more even, thereby facilitating garden management.



Figure 8. Liquid Organic Fertilizer

The production of liquid organic fertilizer (LOF) uses primary materials such as organic waste (vegetables or fruits), water, and sugar or molasses, and may also include microbial activators. The composition of materials generally follows a 3:1:1 ratio: 3 parts organic material, 1 part water, and 1 part sugar. This ratio represents a proportional relationship, in which any change in the quantity of one material must be accompanied by proportional adjustments in the quantities of the others. The application of this proportional relationship is essential for maintaining the balance of the fermentation process, ensuring that the resulting fertilizer is of good quality and effective for use. For example, 6 kg of organic waste requires 2 liters of water and 2 kg of additional materials. The accuracy of this ratio is crucial to maintaining the quality

of the decomposition process and achieving optimal fertilizer outcomes.



Figure 9. Solar Panel Placement

Solar panels are installed with consideration for the angle of inclination and the direction of sunlight exposure. In Indonesia, the optimal angle generally ranges from 10° to 15° to maximize energy absorption. In addition, panels are placed in areas free from shading. The application of angle and orientation concepts supports the efficiency of renewable energy use within the school environment.

DISCUSSION

The research results indicate a mutually reinforcing relationship between the values embedded in the *Nangun Sat Kerthi Loka Bali* vision, the development of Green Behavior, and the application of Ethnomathematics in the educational context. The *Nangun Sat Kerthi Loka Bali* vision emphasizes the harmonious relationship between humans, nature, and culture as the foundation of sustainable development (Mahendra, 2021; Prasada et al., 2024). These values align with the principles of Green Behavior, which refers to actions that reflect environmental awareness in daily life. The integration of local wisdom values in education can strengthen students' character development, particularly in fostering environmentally responsible character (Antara et al., 2025; Hartayani & Wulandari, 2022; Putri et al., 2024). This finding suggests that cultural values are not merely conceptual in nature but also play a strategic role in shaping students' ecological awareness.

In practice, Green Behavior in green schools is manifested through activities such as waste management, organic fertilizer production, greening initiatives, and the use of alternative energy. These activities reflect character development through continuous habituation and direct experiential learning. This finding is consistent with studies indicating that the development of environmentally responsible character is

more effective when implemented through real practices within the school environment (Naziyah et al., 2021; Oktamarina, 2021; Santika et al., 2022). Moreover, schools play a crucial role as agents of change in fostering ecological awareness through school culture and contextual learning (Ginting, 2024; Romadhon et al., 2024). The strengthening of Green Behavior also requires clear indicators in order to develop systematically within the educational process (Azis et al., 2022; Sudaryono & Kartika, 2022).

Furthermore, the analysis indicates that these environmentally responsible activities inherently contain implicit mathematical concepts. The management of *Teba Modern* involves volume calculations; the production of organic fertilizer is related to the proportional composition of materials; garden arrangement considers patterns and regularity; and the use of alternative energy is associated with efficiency and measurement. This suggests that the practice of Green Behavior has strong potential as a contextual and meaningful source for mathematics learning. This finding is supported by studies stating that cultural activities and daily life practices contain mathematical concepts that can be utilized in learning (Rosady et al., 2024; Tamariska et al., 2024). Thus, mathematics learning is not merely abstract but can be integrated into students' real-life activities.

In this context, Ethnomathematics serves as an approach that bridges the relationships among culture, the environment, and mathematics learning. Ethnomathematics enables students to understand mathematical concepts through contextual experiences that are closely related to their daily lives (Naja et al., 2022; Putra & Prasetyo, 2022). Furthermore, Ethnomathematics contributes to character development by integrating cultural values into the learning process (Siregar et al., 2024; Sulfayanti et al., 2022). The application of Ethnomathematics in environmentally responsible activities has been shown to enhance students' understanding of mathematical concepts while simultaneously strengthening their environmental awareness (Jusmawati & Nurmala, 2025; Sunantara et al., 2024). This indicates that Ethnomathematics serves not only as a learning approach but also as a strategy for optimizing Green Behavior through more structured, measurable activity planning.

Overall, the relationship among *Nangun Sat Kerthi Loka Bali*, Green Behavior, and Ethnomathematics constitutes a synergistic and complementary framework. The *Sad Kerthi* values serve as the philosophical foundation for developing ecological awareness; Green Behavior represents its practical implementation in daily life, while Ethnomathematics functions as a bridge that integrates cultural values with learning processes. This relationship suggests that the development of an environmentally responsible character cannot rely merely on habituation but also requires reinforcement through contextual and culture-based learning approaches. Therefore, the optimization of Ethnomathematics in environmentally responsible activities has the potential to become an effective strategy for supporting the implementation of *Nangun Sat Kerthi Loka Bali* values in education, while also addressing increasingly complex environmental challenges (Nasution & Kahpi, 2025; Rahawarin & Selanno, 2026).

CONCLUSIONS AND RECOMMENDATION

This study concludes that the values of *Nangun Sat Kerthi Loka Bali*, rooted in *Sad Kerthi*, are integrally linked to the six dimensions of Green Behavior at Adiwiyata Mandiri schools. The findings indicate that the Green Behavior practices implemented by schools not only foster ecological habits but also directly incorporate Ethnomathematics activities rooted in local culture. These activities can be explained through Bishop's mathematical activities, thereby demonstrating that mathematical concepts are present in the context of the school's environmental care practices.

The primary research contribution is to affirm that green behavior in Adiwiyata schools can be understood as environmental education practices that simultaneously incorporate Ethnomathematics, ensuring that the development of an environmentally conscious character and mathematical learning do not proceed in isolation. Thus, Ethnomathematics strengthens the connection between local wisdom values, environmental care activities, and mathematics learning within the context of sustainable education. The integration of *Sad Kerthi* values into Green Behavior practices, deepened through Ethnomathematics, has the potential to

strengthen the development of an environmentally conscious character while reinforcing the internalization of the *Nangun Sat Kerthi Loka Bali* values in sustainable educational practices at the school.

Adiwiyata schools are encouraged to optimize the integration of environmental stewardship activities into their curriculum, particularly through an Ethnomathematics approach, to ensure a more systematic and focused approach. Other schools can adopt this practice to integrate mathematics education, environmental stewardship, and local wisdom into their educational activities. For policymakers, these findings can serve as a guide for strengthening culture-based environmental education in a more holistic manner.

Limitation

This study has limitations in the Ethnomathematics dimension, as the mathematical analysis remains focused on specific aspects of mathematical activities within the practice of Green Behavior in schools and therefore does not fully encompass all potential mathematical aspects that may emerge from these activities. In addition, this study was conducted only in several Adiwiyata Mandiri schools in Buleleng, which limits the generalizability of the findings.

Credit authorship contribution statement

Authors 1, 2, 3, 4, and 5 contributed to the research design, data collection, implementation of observations and interviews, literature review, data analysis, and preparation of the initial draft of the manuscript. Authors 6, 7, 8, and 9 contributed through conceptual guidance and provided continuous direction throughout the research process. All authors contributed to the completion of the study.

Declaration of competing interest

The authors declare that there are no financial or personal relationships that could have influenced the results of this study.

Ethical Declaration

All participants provide informed consent prior to their involvement in the study. Participants were informed about the objectives, procedures, and their right to withdraw at any time without any consequences. This study was conducted in accordance with ethical principles in educational research.

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