



Ethnomathematics and Renewable Education in the Village of Tanjungjaya Village, Panimbang District, Pandeglang Regency, Banten

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Abstract

This study explores the integration of ethnomathematics and renewable education in Pandeglan village, Tanjung Jaya, Banten, Indonesia. Using a qualitative case study approach, it explores how indigenous mathematical practices can be integrated into formal education alongside modern technology. The findings reveal that ethnomathematics is deeply embedded in the daily life of the village, especially in agriculture and traditional crafts. Local practices show that geometry and measurement concepts are intuitively applied. In schools, teachers are beginning to incorporate these cultural elements into math lessons, increasing students' motivation and understanding. Some schools demonstrate their commitment to renewable education by adopting computer technology and internet-based teaching materials. However, there are significant implementation challenges, such as limited infrastructure and insufficient teacher training in educational technology. The integration of ethnomathematics and renewable education shows promise in developing students' mathematical and cultural understanding. This approach connects abstract concepts to familiar contexts while introducing modern learning tools. Challenges faced include inadequate technology access, unstable internet connections and teachers' low proficiency with digital tools. The study recommends improving technology infrastructure, conducting regular teacher trainings, developing culturally appropriate educational practices, and fostering collaboration between schools, government and higher education institutions. In conclusion, the study shows that combining ethnomathematics and renewable education has the potential to improve the quality of education in rural areas. It highlights the importance of contextualizing learning within local culture while using modern educational technologies. With appropriate support and implementation, this integrated approach can serve as a model for strengthening education in similar rural contexts.

Keywords: Ethnomathematics, technology integration, local wisdom, contextual learning, Tanjung Jaya village, culture-based learning

1. Introduction

Education plays a central role in shaping a young generation that is competent and able to face global challenges. But to achieve this, it is important that the education system responds to local needs and different approaches appropriate to contexts (Mansilla and Wilson, 2020). In Indonesia, it is often a challenge to match local needs with national education, which often refers to international curricula. This creates a gap between what is taught in schools and the daily lives of students, especially in rural areas where local knowledge is abundant. One solution to bridge this gap is to incorporate an ethnomathematical approach into the educational process (Reimers, 2020).

Ethnomathematics is a discipline that combines mathematical concepts with local cultural practices. This approach helps students understand mathematics in the context of everyday life and facilitates the understanding of abstract concepts (Steffensen, 2021). The village of Tanjung Jaya in Panimbang Sub-district, Pandeglang Province, Banten is an example of a site with great potential for the application of ethnomathematics. With a strong local tradition and culture, the values of the village can be used as material for appropriate mathematics learning.

The village of Tanjung Jaya is an area with great potential for the application of ethnomathematics, but it is also a great challenge brought about by rapid technological development. Renewable education that integrates technology into the learning process is a solution to improve access and quality of education in remote areas. Through the use of technology, students in villages like Tanjung Jaya can access the same information and educational resources as students in big cities. This use of technology in education is known as part of renewable education and involves the use of digital tools, e-learning platforms and technology-based learning applications (Novianti et al., 2024).

However, integrating ethnomathematics and renewable education is not easy. Many schools in rural areas lack adequate technological infrastructure and teachers are often not trained to use technology as a teaching tool. In

addition, the understanding of ethnomathematics among education professionals is still limited and its application is not optimal. Therefore, in-depth research is needed to understand how the two approaches can be effectively integrated in rural schools such as in Tanjung Jaya village.

The purpose of this study is to investigate the implementation of ethnomathematics and renewable education in Tanjung Jaya village and analyze how these two approaches can be integrated to create contextualized learning that suits the needs of students and local communities. It is hoped that by combining ethnomathematics and renewable education, students will be able to learn mathematics in a more understandable, relevant and engaging way, while at the same time developing the technological skills they need to face an increasingly digitalized world (Long and Chik, 2020).

The village of Tanjung Jaya is located in the Pandeglan Province of Banten, known for its natural beauty and cultural richness. The people of this village are mostly farmers and fishermen who still strongly preserve local traditions and wisdom. The natural incorporation of mathematical concepts into many of the community's daily activities, such as calculating planting times, measuring land and selling produce at the market, provides an ideal setting for the development of ethnomathematic approaches in education. Unfortunately, although people often use mathematics unconsciously, this knowledge is rarely formalized in the form of schooling (Mukminin and Kurniawan, 2020).

The education system in Tanjung Jaya village still follows the national curriculum and often pays little attention to the local context. This curriculum tends to teach mathematics in an abstract and theoretical approach, which is often difficult for students to understand. Many students feel that mathematics is a difficult subject and irrelevant to their daily lives. As a result, students are less motivated to learn mathematics, which has an impact on low academic achievement in the subject.

The ethnomathematics approach can solve this problem. By relating mathematical concepts to everyday activities that students are familiar with, mathematics learning becomes more meaningful and relevant. For example, in geometry lessons, teachers can use traditional buildings and local textile patterns as teaching tools to teach the concepts of shape and symmetry. Similarly, in a mathematics lesson, the concept of computation can be taught using the example of trading activities in a local market. Such an approach not only improves students' understanding of mathematics, but also helps preserve local culture.

Furthermore, renewable education also plays an important role in improving the quality of education in Tanjung Jaya villages. Technological advances have given students in remote villages like Tanjung Jaya Village the opportunity to access a wider range of information and educational resources. The use of technology such as computers, tablets and smartphones in the learning process can open up a new world for students, enabling them to learn through learning videos, interactive simulations and engaging learning applications. The challenge, however, is how to integrate this technology with an ethnomathematical approach so that students can learn in the context of local culture while developing the technological skills they will need for the future.

In the village of Tanjung Jaya, the introduction of renewable education is still limited. Computer hardware has been introduced in some schools, but its use remains marginal. Many teachers have not been trained to use technology as a teaching tool and technological infrastructure such as internet networks are inadequate. Therefore, teachers in these villages need training to enable them to make the best use of technology in the learning process. In addition, the government also needs to improve the technological infrastructure in remote villages for renewable education to be more effective.

The integration of ethnomathematics and renewable education is expected to create an education system that is more contextualized and better suited to the needs of local communities. This approach allows students to learn mathematics not only as a subject disconnected from their lives, but also in direct connection with their daily activities and culture. Moreover, the use of technology in the learning process prepares students to face the challenges of an increasingly digitalized world.

In an increasingly globalized world, it is important that rural communities like the village of Tanjung Jaya are not left behind in terms of education. By combining ethnomathematics and regenerative education, this village can serve as an example of how education can be adapted to local conditions while taking advantage of technological advances. This study is expected to make a significant contribution to improving education in rural areas, especially in terms of integrating cultural and technological approaches into the learning process. As part of this study, a detailed analysis will be conducted on how ethnomathematics is practiced in the village of Tanjung Jaya and how renewable education in this area can be optimized (Rosa et al., 2022). It is hoped that the results of this study will guide teachers, policy makers and governments to develop more appropriate and sustainable educational strategies in remote areas. Thus, the integration of ethnomathematics and renewable education will not only improve the quality of education, but also strengthen local cultural identity and empower students to face the changing world.

2. Literature Review

2.1. Ethnomathematics

Ethnomathematics is an approach that relates mathematics to the culture and local wisdom of a society. The concept was first introduced by Brazilian mathematician Ubiratan D'Ambrosio in the form of a study of how people in

different parts of the world use mathematics in their daily lives (Rosa and Orey, 2021). This approach aims to bridge the gap between the science taught in schools and the cultural practices that already exist in societies.

Ethnomathematics not only teaches students numbers and mathematical symbols, but also helps them understand how these concepts are applied in real everyday life. In many cultures, mathematics is used for a variety of activities such as measuring crop yields, building houses, determining time and trading activities. This approach allows students to see direct links between mathematics and local activities such as weaving, traditional building and agricultural systems that use geometric calculations (Machaba and Dhlamini, 2021).

Linking mathematics to the cultural context they understand increases students' motivation to learn. They realize that mathematics is not abstract and esoteric, but an appropriate tool for solving real problems in everyday life. This approach also helps preserve local culture as it draws on traditional practices that the younger generation may have forgotten.

2.2. Renewable education

Renewable education is an approach that integrates technology into the learning process to support broad access to quality education. In the digital age, renewable education is becoming increasingly important to prepare learners for an increasingly complex, technology-driven world. With access to digital devices, e-learning platforms and online resources, education is no longer limited by time or space (Chavarría-Bolaños et al., 2020).

The use of technology in education can enhance learning. Students can learn through a variety of interactive media designed to make learning more engaging, such as videos, simulations and apps (Tuma, 2021). Technology also provides access to global knowledge and enriches students' perspectives on different subjects. In remote areas such as the village of Tanjung Jaya, renewable education can be a solution to overcome limited educational infrastructure and resources.

However, RE brings its own challenges, especially in rural areas where internet access and technological equipment are still inadequate. For the use of technology in the learning process to be effective, the technological skills of teachers and students need to be developed (Ferri et al, 2020). Therefore, the support of various stakeholders, including government and the private sector, is needed to provide the necessary infrastructure and train teachers to use technology as a teaching tool.

2.3. Integrating ethnomathematics and renewable education

Integrating ethnomathematics and renewable education is a strategic step towards creating a contextualized education that meets the needs of local communities while preparing students to face global challenges. In the context of the village of Tanjung Jaya, Banten, these two approaches can be combined to improve the effectiveness of math learning and introduce students to technologies that will be important in the future.

This can be done by using technology to document local wisdom and integrate it into learning materials. For example, they could design a learning application that demonstrates the geometry of local arts and crafts or develop interactive simulations that show calculations used in local agriculture and fisheries. In this way, students can both learn mathematics through their own culture and become familiar with the use of technology as part of the learning process.

3. Methods

This study uses a qualitative approach with case study method to analyze ethnomathematics and renewable education practices in Tanjung Jaya village, Panimbang sub-district, Pandeglang province, Banten. The aim of the study is to understand how the integration of local wisdom in the context of ethnomathematics and the use of educational technology can be applied in the local learning process. The methodology of the study is described below:

3.1. Research design

The research design is a descriptive case study. The case study was chosen because it focuses on the implementation of ethnomathematics and regenerative education in a specific place, namely the village of Tanjung Jaya. The aim of this descriptive study is to detail the implementation of the two approaches to learning and their impact on students and the local community.

3.2. Location and scope of the study

The study was conducted in Tanjung Jaya village, Panimbang sub-district, Pandeglang province, Banten. This village was chosen because it has a rich local culture that can be associated with the concept of ethnomathematics and limited access to education that can be overcome through renewable education. The study population is as follows:

3.2.1. Teachers

Teachers teaching mathematics in primary and secondary schools in Tanjung Jaya village.

3.2.2. Student

Students studying in these schools, especially those taking mathematics courses.

3.2.3. Local community

Community leaders with knowledge of local cultural practices, especially practical mathematics in everyday life.

3.2.4. Policy makers

School principals, education department representatives and local policy makers interested in education in the village.

3.3. Data collection

Data for this study were collected using a variety of methods to gain a comprehensive understanding. The data collection techniques used were as follows.

3.3.1. Participant observation

Direct observation of the learning process in the classroom, especially in mathematics lessons, to determine how ethnomathematics and educational technology are applied. Observations were also made in the community to identify daily activities related to local math concepts.

3.3.2. In-depth interviews

Teachers, students and community leaders were interviewed to get their views on the importance of local wisdom in learning mathematics and the use of technology in education. The interviews were semi-structured to allow participants to respond in a detailed and open-ended manner.

3.3.3. Focus Group Discussions (FGDs)

The possibilities and challenges of implementing ethnomathematics and regenerative education in Tanjung Jaya village were discussed with teachers and community members.

Documentation of teaching and learning activities in the school and data such as teaching materials, photos and videos related to community activities related to mathematics. This documentation helped to visualize the observed practices.

3.4. Data analysis

The collected data were analyzed qualitatively using thematic analysis methods. The data analysis procedure was as follows

3.4.1. Data reduction

Data from interviews, observations and documents were reduced to focus on information relevant to the study, particularly in relation to ethnomathematical practices and regenerative education.

3.4.2. Thematic groupings

The reduced data were grouped under main themes such as the application of ethnomathematics in learning, the use of technology in education, the challenges faced by teachers and students, and the impact of the integration of these two approaches.

3.4.3. Interpretation of data

After organizing the data into themes, the researcher interprets them, understands the relationships between the themes and draws conclusions from the facts found in the field.

3.5. Data validity

Several steps were taken to ensure the validity of the data:

3.5.1. Triangulation

Source triangulation was done by comparing data from interviews with teachers, students and the local community. In addition, the method was triangulated by comparing the results of interviews, observations and documentation.

3.5.2. Member checking

The results of the interviews and interpretation of the data were fed back to the participants to ensure that the researcher's interpretations were consistent with the participants' intentions.

3.5.3. Peer debriefing

The researcher also held discussions with colleagues who were not involved in the study to get their opinions and validate the results of the analysis.

3.6. Survey procedure

The research procedure included the following stages:

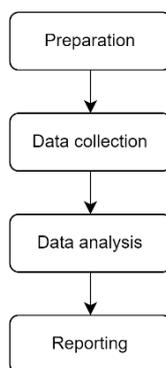


Figure 1: Stages of research procedures

3.7. Limitations of the study

The study has several limitations that need to be considered.

3.7.1. Time limitations

The study was conducted over a limited time period and may not have captured long-term changes in the implementation of ethnomathematics and renewable education.

3.7.2. Access to technology

Limited technological infrastructure in remote areas may have affected the validity of data on the implementation of renewable education.

4. Results and Discussion

4.1. Application of ethnomathematics in learning

The results show that ethnomathematics is an integral part of the daily life of the people of Tanjung Jaya village, especially in the context of agriculture and traditional crafts. Villagers, mostly farmers, intuitively use various mathematical concepts in their agricultural activities. For example, they use simple geometric measurements to determine the area of land to be cultivated. Farmers often measure land in a very practical way, using familiar traditional tools and relying on experience and knowledge passed down from generation to generation. This reflects their application of concepts such as area, comparison and ratio without realizing that they are using formal mathematical principles.

In addition to agriculture, ethnomathematics is also seen in local crafts, especially in wickerwork. Artisans use symmetrical and geometric patterns inspired by local culture. In the production process, the principles of geometry are used to create beautiful and functional patterns. The use of regular and symmetrical patterns shows an unconscious understanding of mathematical concepts such as symmetry, rotation and reflection. The use of traditional measurement systems such as local scales in trade and household economies is another example of how people apply mathematical concepts in their daily lives. People often use non-standardized units of measurement, such as cups and

cats, to measure materials in their daily lives, indicating that they are able to interact with the concepts in a practical way despite having no formal training in mathematics.

In schools, the application of ethnomathematics in mathematics learning becomes visible through teachers' efforts to relate the material to local practices. For example, in geometry lessons, teachers use traditional bamboo weaving patterns to explain the concepts of symmetry and pattern. They also engage students in practical activities involving measurement, such as determining the area of land for a school plant project. In this way, students not only learn mathematical theory, but also become aware of the practical applications of the concepts in their own lives. Interviews with many teachers revealed that this approach helps students to understand mathematical concepts more easily. Teachers reported that students' motivation and enthusiasm for teaching increased as they were able to relate the concepts taught to their daily experiences. Through this activity, students feel that learning mathematics is not something separate from their lives, but something they can use and apply directly.

4.2. Use of renewable educational technologies

Meanwhile, although the village of Tanjung Jaya is classified as a remote area, schools are making efforts to utilize technology in the learning process. Observations and interviews show that some schools in this village have access to computer equipment and the internet, although their numbers are still limited. Teachers try to use these devices by accessing additional teaching materials and mathematical learning applications that support the teaching and learning process. However, access to this technology is not evenly spread across all classrooms as infrastructure is still limited. Most teachers cited lack of appropriate equipment and unstable internet access as the main barriers to utilizing the technology. The very poor internet signal in some rural areas limits the best use of internet-based technology in learning activities.

However, the use of technology in mathematics learning has shown positive results, especially in improving students' understanding. Some teachers have successfully used math-based learning applications in school computer rooms to support the learning process. Students also access online learning materials through mobile phones, but this is still limited and depends on the availability of students' personal devices. Interviews with students revealed that technology has helped them improve their understanding of abstract mathematical concepts, especially through visualizations and simulations provided by the learning apps. Students understand geometry and algebra concepts more easily through the use of interactive simulations that directly show how these concepts work in a real-world context. This makes the learning experience more fun and engaging for students.

However, while there has been some success in the use of technology, teachers emphasized the need for more training to use technology effectively. Some teachers indicated that they needed guidance in designing learning materials that integrate local wisdom with modern educational technology. It is important that teachers are able to utilize the full potential of available technology and successfully integrate it into their daily learning practices. With appropriate training, teachers can develop creativity in teaching mathematical concepts and use available resources to improve the quality of learning.

4.3. Integration of ethnomathematics and renewable education

The integration of ethnomathematics and renewable education is increasingly seen in some of the learning activities undertaken by teachers. Teachers have developed learning practices that incorporate geometric patterns from local crafts as part of math lessons. They are also documenting local cultural practices related to mathematics, such as weaving patterns and measurement techniques in agriculture, and incorporating them into digital materials accessible to students. In this way, students not only gain a better understanding of math, but also a sense of pride in their local culture. However, infrastructure issues are a major barrier to this integration. According to interviews with teachers and local communities, schools need support for appropriate technical equipment and training for teachers to become competent in integrating local wisdom and modern educational technology.

The benefits of integrating ethnomathematics and educational technology are evident in students' improved understanding of mathematical concepts. Interviews with students revealed that they felt more motivated to learn because the mathematics materials were close to their daily lives. Students felt that the use of technology appropriate to their culture allowed them to be more involved in the learning process. To a limited extent, the use of technology also helped more visual and kinesthetic students to better understand mathematical concepts through pictures, videos and interactive simulations. Teachers reported increased student engagement in class discussions. Some teachers noted that students asked more questions and gave examples from their daily lives that were relevant to the lesson, especially when learning was linked to local cultural activities. This suggests that integrating ethnomathematics and pedagogy can improve students' interaction and engagement in the learning process.

4.4. Challenges encountered in practice

While the research findings reveal many positive possibilities, there are challenges to the implementation of ethnomathematics and regenerative education in Tanjung Jaya village. One of the main challenges is limited access to technology. Many schools in the village are not yet equipped with computers and internet access is not stable. This

limits the use of technology in learning, especially in applications that require an internet connection, such as e-learning platforms and online learning videos. These infrastructure constraints directly affect teachers' and students' access to a wider range of educational information and resources. Many teachers are concerned about not keeping up with the latest technological developments and how this affects the quality of their teaching.

Teachers' ability to use technology is also a major challenge. According to the interviews, many teachers indicated that they need more training in the use of technology to support learning. In particular, many teachers feel that they are not competent enough to use technology effectively, combining local wisdom with modern technology tools. This limitation not only affects their teaching skills but also reduces students' interest in learning mathematics. Therefore, ongoing training and guidance is needed to improve teachers' skills in using technology and incorporating it into their daily learning practices.

4.5. Suggestions and recommendations

Based on the findings of the study, several recommendations can be made to overcome the challenges faced and maximize the potential of ethnic mathematics and renewable education in Tanjung Jaya village. First, there is a need to improve the technological infrastructure by installing internet access and computer equipment in schools with the support of the government and the private sector. This will enable more students to have access to quality educational technology. Second, in addition to incorporating local knowledge into the mathematics curriculum, there is a need to organize regular teacher trainings focusing on the use of technology in learning. This training program will enable teachers to use technology with confidence and relate it to local cultural practices.

Third, technology-based learning applications that integrate local cultural elements, such as ethnomathematics, should be developed. Such applications can support learning in the local context and help students understand mathematical concepts in a more engaging way. Furthermore, collaboration between schools, government and higher education institutions is also important in developing programs that can support educational research and development in villages. With the implementation of these measures, Tanjung Jaya village has the potential to become an example in the integration of contextual education based on local culture and modern technology, which can positively impact the quality of education in the region.

Therefore, this study shows that ethnomathematics and renewable education practices can significantly contribute to improving the quality of education in Tanjung Jaya village. This confirms the importance of paying attention to the cultural and local context in the learning process and the need for appropriate technical support to achieve better educational goals. With the right approach, ethnomathematics can not only enrich students' learning experience, but also help them to better understand and appreciate their own culture.

5. Conclusion

This study reveals the important role of ethnomathematics in the life of the people of Tanjung Jaya village, Pandeglan province, Banten. Deeply rooted in agricultural activities and traditional crafts, local mathematical practices reflect a rich mathematical knowledge that has long existed but is often overlooked in formal education. Incorporating ethnic mathematics into the school curriculum has proven to have significant positive effects. Students developed a deeper understanding of mathematical concepts, increased their motivation to learn and improved their ability to relate theory to everyday practice. This approach not only enriches the learning experience, but also strengthens students' cultural identity and self-esteem as members of society.

Meanwhile, efforts to integrate modern technology into renewable forms of education show great potential, although their application is still limited. The use of computers, learning applications and internet resources, although varied, has helped to expand students' access to learning materials and improve their visualization of abstract mathematical concepts. The combination of ethnomathematics and renewable education creates a unique learning environment where local wisdom and innovation synergize. This approach enables students to understand their cultural heritage while developing the digital skills needed for the future.

However, there are a number of challenges in implementing this integrated approach. Limited technological infrastructure such as unstable internet access and lack of computer equipment are major obstacles. In addition, many teachers lack confidence in integrating technology into their teaching, indicating an urgent need for comprehensive training. The digital divide between urban and rural areas is also a concern and could widen the education gap if not properly addressed.

The study recommends a multi-stakeholder approach involving government, the private sector and higher education institutions to address these challenges. Investing in technology infrastructure, including the provision of stable internet access and appropriate computer equipment, is a top priority. Continuous and intensive teacher training programs are needed to build capacity to integrate technology and ethnomathematics into education. The development of technology-based learning applications that integrate local cultural elements is also suggested as a long-term solution.

The study also emphasizes the importance of educational policies that are more flexible and responsive to local needs. National curricula should provide more space for the integration of local knowledge so that education is not only globally relevant but also meaningful in local contexts. Collaboration between education experts, traditional

leaders and technology practitioners in the development of teaching materials can bridge the gap between tradition and modernity.

In conclusion, this study shows the great potential of integrating ethnomathematics and renewable education in improving the quality of education in rural areas. This approach not only improves academic performance, but also strengthens cultural identity and prepares students to face global challenges. The village of Tanjung Jaya has the potential to become a pioneering model for the implementation of contextual, culturally grounded and technologically robust education. The success of this model could be adopted in other rural areas of Indonesia, paving the way for a more inclusive, relevant and competitive education system in the digital age. This research therefore not only contributes to the academic discourse on ethnomathematics and educational technology, but also offers practical solutions to improve the quality of education and preserve local wisdom in the context of modernization.

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