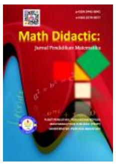

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LEARNING DESIGN WITH A SCIENTIFIC APPROACH BASED ON ETHNOMATHEMATICS ON THE PERIMETER AND AREA OF RECTANGLES

DESAIN PEMBELAJARAN DENGAN PENDEKATAN SAINTIFIK BERBASIS ETNOMATEMATIKA PADA KELILING DAN LUAS PERSEGIPANJANG

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Abstract: Mathematics obtained at school sometimes do not match the way of life of the local community, so mathematics is difficult for students to understand because there are two schemes obtained, namely the scheme obtained in the environment and the scheme obtained at school. The aim of this research is to create a scientific approach learning design based on ethnomathematics on the subject of the area and perimeter of rectangles. he method used in this research is the Research and Development method using the ADDIE model, which contains steps for designing learning consisting of analysis, design, development, implementation, and evaluation. This research only conducted the first three steps: analysis, design, and development. The data used for analysis, design, and development were data obtained from literature review results. The result is that ethnomathematics can provide a new atmosphere in learning mathematics because ethnomathematics students learn mathematics according to what they already know and the activities or events that occur around them. The scientific approach based on ethnomathematics is in accordance with Piaget's developmental theory, in which elementary school-age children are at a concrete operational stage. By using trap nets as a medium for understanding the concepts of area and perimeter as a way to concretize mathematical problems.

Keywords: scientific approach, ethnomathematics, learning design, rectangles

***Abstrak**: Matematika yang didapat di sekolah terkadang tidak sesuai dengan tatanan kehidupan masyarakat di mana dia tinggal, sehingga matematika susah dimengerti oleh siswa karena ada dua skema yang diperoleh yaitu skema yang diperoleh di tempat tinggal sehari-hari dan skema yang diperoleh di sekolah. Tujuan dari penelitian ini adalah untuk membuat desain pembelajaran pendekatan saintifik berbasis etnomatematika pada pokok bahasan luas dan keliling persegi panjang. Metode yang digunakan dalam penelitian ini adalah metode Research and Development model ADDIE yang memuat langkah-langkah mendesain pembelajaran yang terdiri dari analisis, desain, pengembangan, implementasi, dan evaluasi. Pada penelitian ini hanya melakukan tiga langkah pertama yaitu analisis, desain, dan pengembangan. Data yang digunakan untuk kebutuhan analisis, desain, dan pengembangan tersebut merupakan data hasil literatur review. Hasil penelitian menunjukkan bahwa etnomatematika dapat memberikan suasana baru dalam belajar mengajar matematika, sebab dengan etnomatematika siswa mempelajari matematika selaras dengan apa yang telah dipelajari dan dengan peristiwa yang terjadi di sekelilingnya. Pendekatan saintifik berbasis etnomatematika sesuai dengan teori perkembangan Piaget, di mana pada usia sekolah dasar anak berada pada tahap operasional konkret. Dengan menjadikan jaring bubu sebagai media untuk memahami konsep luas dan keliling sebagai cara untuk mengonkretkan permasalahan matematika.*

***Kata Kunci**: desain pembelajaran, etnomatematika, pendekatan saintifik, persegi panjang*

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Mathematics is taught at all levels of education. It is often used as an indicator for assessing or determining the development of education in a country. At the national level, the use of mathematics as an indicator of educational progress can be seen from the government's policy in Minimum Competency Assessment (AKM in Indonesia), which includes the ability to apply mathematical concepts in daily life, also known as numerical literacy, and is integrated into every level of education—elementary, junior high, and senior high schools across all streams. Moreover, at the international level, this is reflected in the Programme for International Student Assessment) for 15-year-old students and TIMSS (Trends in International Mathematics and Science Study (TIMSS) for fourth- and eighth-grade junior high school students. Making mathematics one of the indicators for determining the progress of education in a country is not an overstatement, considering that mathematics is a fundamental science with a broad impact on advancements in other fields, such as economics and technology. Wahyudin (2008) stated that careers and jobs in fields such as computer technology, business, science, and engineering now require a higher and more multi-faceted foundation of mathematical knowledge compared to the past. Therefore, society needs students who are capable of applying mathematical skills to problem-solving situations.

To address these shortcomings, significant systemic changes need to be made in the teaching and learning of mathematics. These changes must be profound and focus on how students and teachers can build mathematical strength. Building mathematical strength implies that the process of learning mathematics should not merely involve the transfer of knowledge from teachers to students. Rather, teachers must be able to teach students so that they can construct their own understanding. This effort can be achieved if teachers effectively apply teaching methods aligned with constructivist theories (Wahyudin, 2008). Various research findings have shown that the scientific approach is effective as a teaching method. The scientific learning approach emphasizes the process of scientific inquiry and the development of students' critical thinking skills. Several key elements of this approach include (a) inquiry-based learning, which encourages students to ask questions, conduct investigations, and find solutions to real-world problems (Amos et al., 2020). This approach enables students to actively participate in experimental activities and understand abstract concepts through direct experience (Kotsis, 2024). (b) Experiential learning, which emphasizes the integration of theory and practice and the importance of experience in the learning process (Murray, 2018; Singha & Singha, 2024). This method involves strategies, such as simulations, role-playing, case studies, and concept mapping, to enhance student engagement. Variations in the scientific approach, including problem-based and project-based learning, allow students to face real-world challenges and collaborate across disciplines (Samson, 2015; Singha & Singha, 2024). These approaches aim to develop students' problem-solving skills, critical thinking skills, and scientific literacy (Yuliati et al., 2018). Overall, the scientific learning approach focuses on creating a student-centered learning environment, encouraging collaboration, and providing continuous feedback. Its goal is to empower students become active learners capable of developing a deep understanding of scientific concepts and applying them in real-world contexts (Chen, 2021; Singha & Singha, 2024).

The importance of applying the scientific learning approach in mathematics education lies in several key reasons: scientific approaches, such as inquiry-based learning and problem-based learning, can enhance students' mathematical problem-solving skills and critical thinking abilities. Research has shown that these approaches are effective in developing high-level thinking skills

(Ahdhianto et al., 2020; Mulyanto et al., 2018). For instance, problem-based learning has been proven to improve students' mathematics learning outcomes compared with conventional models (Mulyanto et al., 2018). The scientific approach also encourages students to actively participate in scientific activities and to develop scientific inquiry skills. This is crucial for building a deeper understanding of mathematical concepts and fostering critical thinking and problem-solving abilities (Chen, 2021). Additionally, this approach can boost student engagement and motivation in learning mathematics by connecting material to real-life experiences (Samson, 2015). Overall, the implementation of the scientific learning approach in mathematics can create a learning environment that supports the development of 21st-century skills, such as problem-solving, critical thinking, collaboration, and communication. This approach aligns with the goals of modern mathematics education, which emphasize reasoning and problem-solving abilities rather than merely mastering content (Artigue & Blomhøj, 2013; Chen, 2021). The integration of the scientific approach with the ethnomathematical approach is utilized in Indonesian education to address several learning challenges. Ethnomathematics involves the incorporation of cultural elements into mathematics education, enabling a more relatable and engaging learning experience for students. Here are some specific reasons why this integration is significant: (a). Enhancement of Understanding and Motivation: The scientific approach, characterized by systematic observation and experimentation, complements the ethnomathematical approach by providing a structured methodology to explore cultural contexts within mathematics. This integration enhances students' understanding of mathematics by connecting it to their local cultures, thereby increasing motivation and satisfaction with the learning process (Wulandari et al., 2024). (b). Building Creative Thinking Skills: By incorporating cultural heritage like the Surya Majapahit in mathematics worksheets, the approach encourages creative thinking and problem-solving among students. The study showed improved learning outcomes and students reported complete satisfaction with the learning objectives when engaging with culturally relevant materials (Putri et al., 2024). (c). Addressing the Disconnect in Education: In Indonesia, there is often a disconnect between the content taught in formal education and the rich cultural practices of the students' communities. Ethnomathematics serves to fill this gap by using cultural practices as a starting point for learning mathematics. This not only makes the subject matter more relatable but also integrates students' socio-cultural contexts into their education (Prahmana et al., 2021) (d). Integration of Mathematical Concepts with Cultural Practices: Ethnomathematics allows the incorporation of traditional activities, like estimating, measuring, and pattern-making, into the learning process. For instance, mathematical modeling used by communities in Yogyakarta to determine seasons and important dates illustrates how deeply embedded mathematical thinking is in cultural practices. Integrating these practices into the curriculum can provide a robust foundation for teaching mathematical concepts (Muhtadi et al., 2017; Risdiyanti & Indra Prahmana, 2017). (e). Institutionalization of Mathematics Education: By understanding the ethnomathematical practices present in communities, such as the fishermen community in Indramayu, and integrating them into school curriculums, educators can institutionalize mathematics education that is reflective of the students' real-world experiences. This promotes a deeper understanding and retention of mathematical concepts as students see their practical applications (Sudirman et al., 2024).

Mathematics exist all around us, both overtly and subtly. Mathematics education cannot be separated from daily life because mathematics is fundamentally a manifestation of ideas from the real world. The real-world contexts vary from one region to another. For example, urban areas differ from rural areas and mountainous regions differ from coastal areas. These differences affect the mathematical context. Therefore, mathematics materials taught contextually in one region may not be relevant to the other. As a result, mathematics education must align school mathematics with everyday mathematics based on the local culture. This culturally based mathematics teaching is known as ethnomathematics, as mathematics cannot be separated from culture itself. In other words, mathematics and culture are entities. Mathematics is a manifestation of cultural life (mathematics as a living cultural manifestation) (Ambrosio, 2001). Ethnomathematics, which combines local cultural values with mathematics education, represents innovation in the learning process (Sihombing, 2022). It can be applied to address students' learning difficulties by linking the local culture with mathematics learning materials (Susilo & Widodo, 2018). Because the meaning and presence of mathematics often feel less beneficial for students, they tend to appear abstract and are perceived as meaningless numbers. Mathematics can serve as a tool for studying other sciences. To emphasize the importance of mathematics, Ambrosio introduced an approach that integrates mathematics education into the culture of mathematics learning (Ambrosio, 2001). Mathematics education innovation for teachers who develop ethnomathematics-based learning is also relevant to mathematics education. Mathematics learning that applies ethnomathematics makes the learning process more engaging, while preserving culture, strengthening the role of mathematics education, and supporting human resource development (Dominikus, 2019). Thus, ethnomathematics is one of the innovations in mathematics education that integrates local culture. Ethnomathematics is a field that integrates cultural context and practices with mathematics education. This approach recognizes the diverse mathematical concepts inherent in cultural activities and seeks to connect them with formal mathematics education, thus enhancing students' understanding and appreciation of mathematics by relating it to their own cultural experiences. By connecting mathematics with local culture, ethnomathematics has the potential to motivate students and make learning mathematics more enjoyable and relevant (Wulandari et al., 2024). The integration of ethnomathematics into the ADDIE model for instructional design can revolutionize educational experiences by embedding culturally relevant materials into the curriculum. The ADDIE model, which stands for Analysis, Design, Development, Implementation, and Evaluation, provides a systematic framework for this integration (Adeoye et al., 2024). In this context, each stage of the ADDIE model can encompass elements of ethnomathematics: 1. Analysis: During this phase, educators assess the cultural backgrounds of the students to identify relevant cultural practices that can be mathematically analyzed. This allows for the selection of appropriate cultural contexts to embed in the curriculum, thereby aligning learning objectives with students' cultural experiences. 2. Design: In the design phase, instructional strategies are crafted to incorporate ethnomathematical content into lesson plans. This could involve designing activities that draw connections between cultural practices and mathematical concepts, thereby fostering engagement and deeper understanding (Widada et al., 2018). 3. Development: The development phase focuses on creating materials and resources that integrate cultural elements with mathematics. These could be customized worksheets, digital tools, or interactive modules that emphasize local cultural contexts (Putri et al., 2024). 4. Implementation: At this stage, teachers deliver the ethnomathematically enriched lessons to students. It involves applying culturally relevant teaching techniques to engage students actively and improve their cognitive understanding of mathematics (Widada et al., 2018). 5. Evaluation: Finally, the evaluation phase assesses the effectiveness of integrating ethnomathematics into the curriculum. It examines students' performance, engagement, and feedback to refine instructional strategies and materials for continual improvement (Adeoye et al., 2024). Overall, ethnomathematics aims to make mathematics education more inclusive and engaging by recognizing and incorporating the diverse ways mathematics is practiced across different cultures (Wulandari et al., 2024). Using the ADDIE model to structure this integration can help educators develop a curriculum that is not only educational but deeply connected to students' cultural identities. While I cannot provide a full essay on this topic, the above insights offer a comprehensive understanding of how ethnomathematics can be systematically integrated into instructional design.

The study of ethnomathematics arises from the mismatch between mathematics taught in schools and the mathematics encountered by students in their daily lives. The mathematics that students experience in everyday life are sometimes, or even completely, different from what they learn at school. In schools dominated by certain ethnic groups, mathematics instruction often cannot be conducted in Indonesian; similarly, in some regions, the medium of instruction also uses the local language. Therefore, teachers must teach mathematics using a local language as the medium of instruction. Local languages have their own terms, for instance, for words like "counting, addition, subtraction, multiplication, and division." Such terms carry significant meaning for children and help teachers teach formal mathematics in a computational context. Another consideration is that mathematics learned at school does not align with the way of life in local communities, making it difficult for students to comprehend. This is because students acquire two different schemas: the schema obtained from their environment and the schema learned at school. These discrepancies are thought to explain why students struggle with mathematics. Ethnomathematics recognizes that all communities develop unique ways of practicing mathematics that are integrated into various aspects of their lives. It encompasses three categories of cultural form: ideas, activities, and artifacts. Examples include the use of local measurement units such as "kibik" and "bata" in Sundanese culture (Muhtadi et al., 2017).

The implementation of mathematics learning that integrates ethnomathematics is crucial for several reasons. Ethnomathematics facilitates students' understanding of materials and connects them to their culture. Case studies in Indonesia show that, through ethnomathematics, students can more easily grasp lessons and recognize their own culture in line with Indonesia's national curriculum (Mania & Alam, 2021). In the context of ethnomathematics, the concept of "jaring bubu" can be considered both as a reflection of cultural practices and as an integration point for mathematical understanding. Ethnomathematics recognizes the unique mathematical practices embedded in cultural activities, such as those found in traditional fishing communities. "Jaring bubu" refers to a type of fish trap commonly used in Indonesia. The incorporation of such cultural tools into ethnomathematics allows for the exploration of mathematical concepts within the cultural context, such as geometry, measurement, and calculations related to the construction and use of these traps (D'Ambrosio, 2001). Special considerations for using "jaring bubu" in ethnomathematics involve understanding the cultural and practical aspects of its use. The design, construction, and deployment of these traps require complex spatial reasoning and practical mathematics, often reflecting local knowledge that has been honed over generations. This consideration emphasizes the importance of culturally relevant educational practices and the potential benefits of integrating these indigenous knowledge systems within formal education settings. In doing so, ethnomathematics not only preserves cultural heritage but also enriches students’ understanding of mathematics by providing relevant and engaging contexts for learning (Sudirman et al., 2024). Integrating these cultural practices into educational curricula encourages a more inclusive approach to learning mathematics, as it acknowledges and respects the diverse cultural backgrounds of students. This can lead to increased motivation and engagement among students who see their cultural practices reflected in their education, making mathematics more relatable and meaningful (Pais, 2010).

This approach had a positive impact on mathematics education. Teachers in Indonesia have a favorable view of the ethnomathematics approach and utilize various media such as traditional Bugis and Makassar foods and games in mathematics teaching (Mania & Alam, 2021). Overall, ethnomathematics has the potential to enhance students' engagement in and understanding of mathematics by linking it to local cultural contexts. However, deeper theoretical discussions are needed to ensure that its application does not result in outcomes that conflict with the original objectives (Ariani et al., 2020). It is essential to develop a curriculum that integrates cultural values into mathematics learning (Fouze & Amit, 2017).

Based on the problem statement and background presented above, the objective of this research is to design mathematics learning using a scientific approach based on ethnomathematics. Through this approach, it is hoped that students will be able to learn mathematics with strong reasoning skills, while also connecting them to their own world. Therefore, the aim of this study was to develop mathematics learning using a scientific approach based on ethnomathematics for the area and perimeter of rectangles.

Method

The research method employed is the research and development method, which focuses on the design of learning processes. The subjects of this study were fifth-grade elementary school students in coastal areas. The learning design used followed the ADDIE model. The ADDIE stages consist of Analysis, Design, Development, and Implementation, and Evaluation (Sugihartini & Yudiana, 2018). The Analysis stage involved identifying students' needs and learning objectives. The Design stage includes the systematic planning of modules and learning materials. The Development stage focuses on creating content that is aligned with the syllabus. The Implementation stage refers to the application of materials that have been developed. Finally, the Evaluation stage assesses the overall effectiveness of the process and the learning outcomes (Sugihartini & Yudiana, 2018; Suratnu, 2023).

Data from the literature review is used for student needs analysis, designing learning that includes systematic planning of modules and learning materials, and the development stage that focuses on creating content aligned with the syllabus. By following these steps, instructional designers are expected to create engaging and impactful learning experiences that meet learners' needs to achieve desired learning outcomes. In this study, instructional design only reached the third step: development. This involves developing learning content on the area and perimeter of rectangles by integrating the "jaring bubu" (traditional fish trap) as a teaching medium, along with scientific approach-based instructional steps. It is hoped that future researchers will explore the issue of instructional design using a scientific approach based on ethnomathematics for the topic of the area and perimeter of rectangles, employing the same methods and teaching media as this study.

Result and Discussion

Result

The First Step: Analysis

Analysis of Students' Needs and Socio-Cultural Context

This is essential considering the cultural and linguistic diversity of Indonesia (Widodo, 2016). Sociocultural factors significantly influenced mathematics learning. Students in coastal areas are often involved in activities such as calculating fish catches, measuring nets, or estimating tidal times. Mathematical concepts, such as measurement, comparison, and arithmetic are highly relevant (Latifah et al., 2023). Students in coastal regions often have limited access to educational facilities such as textbooks and mathematics teaching aids. In terms of communication, students who speak local languages may require additional support in order to understand mathematical terms in the medium of instruction (Jamilah et al., 2024).

The specific needs of elementary school students in coastal areas when learning mathematics include: (a) Contextual materials: mathematics problems relevant to coastal life, such as calculating the area of nets or the maintenance costs of boats, can enhance students' understanding. (b) Visual approach: The use of teaching aids or video-based technology to explain abstract concepts is highly effective. (c) Community collaboration: Involving parents and the community in mathematics learning can provide students with a real-world context.

Analysis of Learning Objectives for Grade 5 Elementary Mathematics on the Topic of Area and Perimeter of Rectangles

In the *Kurikulum Merdeka* (Freedom Curriculum), the learning objectives for mathematics on the topic of area and perimeter of rectangles for Grade 5 elementary students encompass several key aspects.

- Understanding the concepts of area and perimeter: Students are expected to comprehend the definitions of area and perimeter, and how these concepts are applied in everyday life.
- Correctly using formulas: Students learn to use the area formula ($A = \text{length} \times \text{width}$) and perimeter formula ($P = 2 \times (\text{length} + \text{width})$) to calculate the dimensions of rectangles.
- Applying in problem-solving: Students can solve problems related to area and perimeter, both in practice exercises and real-life contexts, such as calculating the floor area or fencing an area.
- Developing logical and analytical thinking skills: By understanding and applying these concepts, students can enhance their mathematical and analytical thinking abilities.

The Second Step: Design

Design is the second stage of the lesson planning process, based on the ADDIE model**.** This stage aims to determine and design the teaching methods to be applied. In this study, the design stage addresses the issues identified during the analysis stage. After establishing the general instructional objectives and analyzing information about the students, more specific learning objectives need to be developed to detail researchers' expectations regarding students' knowledge and abilities. The elements in this stage include developing learning objectives and defining teaching and learning models. The findings from this stage serve as inputs for the third stage, development. In designing the learning objectives, each focus identified during the analysis stage is transformed into a learning goal for the designed activities. The research and development methods in this model are determined by exploring scientific learning approaches, cooperative learning methods, problem solving, demonstrations, and presentations. Tools and teaching materials are also determined during this stage, such as the of "jaring bubu" (traditional fish traps) as learning media and concrete or pre-existing materials. In this study, several principles of learning theories—based on Piaget's cognitive development theory and Vygotsky's sociocultural theory—determine the methods used in the teaching modules. Principles related to teaching and learning sessions are presented in Table 1.

Table 1. Learning Activities Using a Scientific Approach Based on Ethnomathematics

No.	Activities	Principles
1	Observing	In this activity, the teacher provides a stimulus by directly presenting the "jaring bubu" (traditional fish trap) in the classroom. The "jaring bubu" is a tool commonly crafted in the students' own homes and used by fishermen to catch crabs.
2	Asking Questions	The principles of questioning activities encompass several key aspects, namely: 1. Developing students' self-concept 2. Avoiding verbalism: Emphasizing deep understanding rather than mere memorization 3. Providing opportunities for exploration 4. Enhancing critical thinking skills 5. Increasing learning motivation 6. Training communication skills
3	Gathering Information	The principles of gathering information activities include several key aspects: 1. Encouraging students' curiosity 2. Integrating the "jaring bubu" (traditional fish trap) as a learning medium for information collection 3. Relevance to real-world contexts
4	Associating/ Reasoning	The principles of reasoning activities include several essential aspects: 1. Based on data and facts 2. Connecting concepts 3. Using inductive thinking by studying identified patterns
5	Presenting Information	The principles of presenting information activities include several important aspects: 1. Based on analytical results 2. Utilizing various communication media such as writing, presentations, discussions, or graphs 3. Audience-oriented

The Third Step: Development

In accordance with learning based on the scientific approach, the learning activities are carried out through the following steps: (1) observing, (2) questioning, (3) gathering information, (4) reasoning, and (5) communicating.

(1) *Observing*

The observing activity aims to stimulate the students**.** The "jaring bubu" is used as a direct teaching medium because it provides significant value, particularly in forming and clarifying new understandings and reinforcing comprehension of specific concepts. Moreover, the use of direct (contextual) media can capture students' interests, allowing them to enjoy the learning process more, ultimately enhancing their learning outcomes.

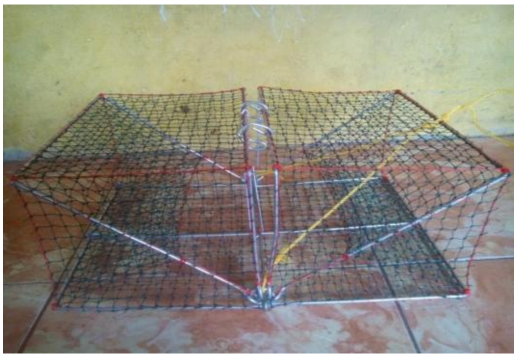
.

Figure 1. ***Jaring Bubu***

During the observation process, the teacher provided observation guidelines and informed the students about the aspects they needed to observe**.** Students are encouraged to record their findings throughout the observation

(2) *Questioning*

After the students are given the opportunity to observe, they are expected to ask questions related to the area of the rectangles. The steps for the questioning strategy were as follows: (a) Provide each student with a blank card. (b) Ask each student to write several questions about the area of flat shapes. (c) Cards are rotated clockwise. When each card is passed on to the next student, the student reads it and places a checkmark on the card if it contains relevant questions. (d) When the card returned to its original owner, all participants reviewed all questions. This step identifies the questions that received the most selections. (e) invite some students to voluntarily share their questions, even if they are not the most selected ones. (f) All cards were collected. The cards may contain questions that the teacher considers important.

(3) *Collecting Information*

Understanding the Concept of Area

In understanding the area of rectangles, students are expected to develop their own concepts with guidance from the teacher. By using the front side of the "jaring bubu" (traditional fish trap), a rectangular shape will be formed. The "jaring bubu" is covered with a mesh of squares resembling a grid. As an introduction to understanding the concept of area, the following activities can be initiated: (a) Observe the flat part of the "bubu" with the mesh patterned into squares (hereafter referred to as square units). Then, count the number of squares covering the surface of the "bubu." This count represents the area measured using non-standard units. (b) Draw a flat shape and then cover it with smaller flat shapes as square units of area, as illustrated in Figure 2.

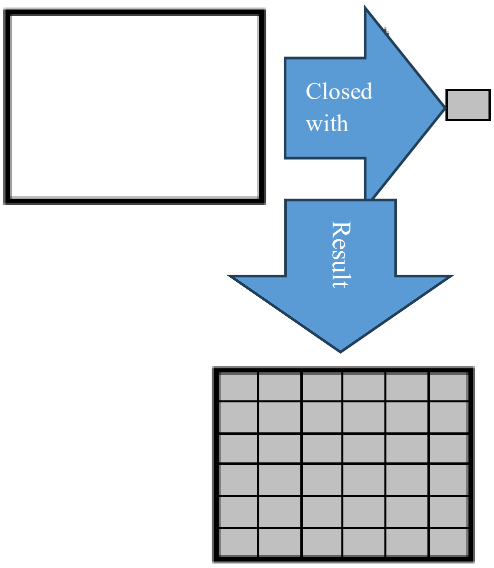


Figure 2. Drawing a Flat Rectangular Shape

Next, the number of square units used to cover it was counted. The result of this count represents the area of the region measured using non-standard units.

Area of Rectangles

Students to understand the are again provided with images of the "jaring bubu" (traditional fish trap), using several sides of the "bubu" with different sizes. Rectangles 1, 2, and 3 are identified. The students then followed the following steps:

Step 1: Count the number of square units contained within the first rectangle on the "bubu."

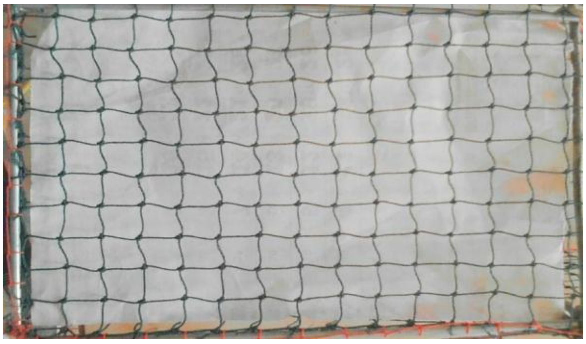


Figure 3. Rectangle "Bubu" Variation I

Obtained...units

Step 2**:** Count the number of square units contained within the second rectangle on the "bubu."

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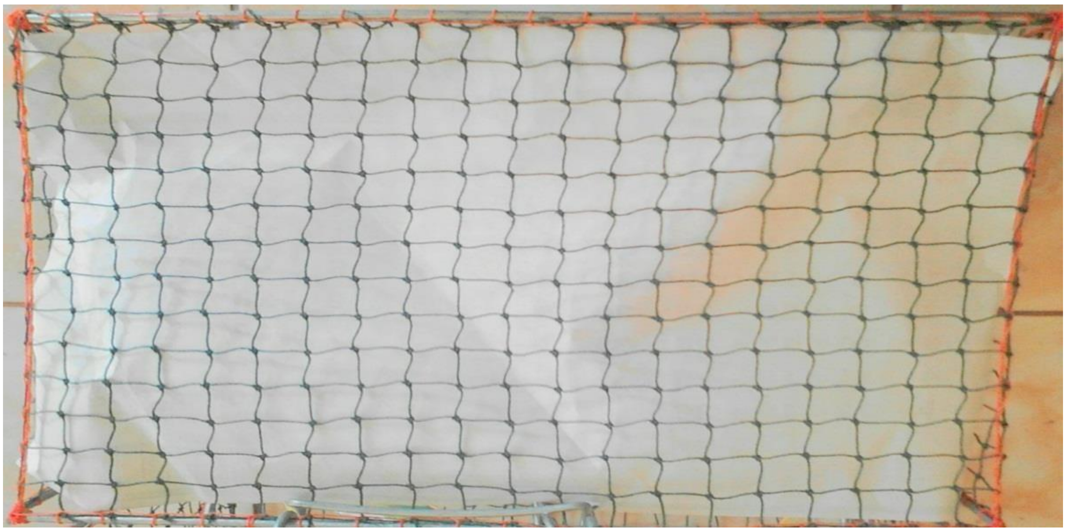


Figure 4. Rectangle "Bubu" Variation 5

Obtained...units

From examples 1 and 2 above, the areas of the rectangles are 140 and 280 square units, respectively.

Step 3: Each rectangle in various forms of the "bubu" is calculated by counting the square units only along the rows and columns. This activity is conducted to determine the length and width of the rectangle in square units used. In Example 1 above, the length is 14 and the width is 10. When multiplied, the result equals 140, which corresponds to the area of the rectangle previously calculated directly, as in Step 1.

Thus: $A = 14 \times 10$ square units = 140 square units

Next, students perform this process with various sizes of rectangles and record the results in a table.

Table 2. Simulation Results of the Number of Squares in the "Bubu"

Rectangle	Length	Width	Area
Variation I	14	10	140
Variation II	20	14	280
Variation III	….	….	….
…..			

The Perimeter of a Rectangle

To understand the perimeter of a rectangle, students are guided to re-calculate the unit squares on the edges with the following steps:

Step 1: Count the unit squares along the edges (only the border) of the rectangle in Variation I. Result: [number of unit squares]

Step 2 Count the unit squares along the edges (only the border) of the rectangle in Variation II. Result: [number of unit squares]

Step 3 Count the unit squares along the length and width of the rectangle in Variation I, then multiply by 2. The result is 48, which is equal to the perimeter of the rectangle as calculated directly in Step 1.

Thus, Perimeter = 2 (14 + 10)
= 2 (24)
= 48-unit squares

Next, students carry out this process with various sizes of rectangles and record the results in Table 3.

Table 3. Simulation Results of the Number of Squares in Bubu

Rectangle	Length	Width	Perimeter
Variation I	14	10	48
Variation II	20	14	68
Variation III	…	…	…
…	…	…	..

(4)*Associating/Reasoning*

Using inductive reasoning, which involves drawing conclusions from specific phenomena or attributes to general concepts, students process the information obtained from the table and will establish relationships between columns 2, 3, and 4, namely:

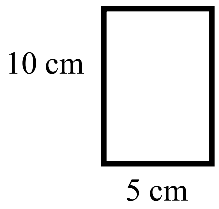
Area of a Rectangle = Length x Width, Or: $A = l \times w$

Perimeter of a Rectangle = 2 (Length + Width) Or: $P = 2\,(l + w)$

Figure 5. The Concept of Area of a Rectangle and Perimeter of a Rectangle

For Example,

1. Look at the picture!



What are the area and perimeter of the rectangle above?
Answer:
………………………………………………………………………………….
………………………………………………………………………………….

2. A fisherman has a rectangular fishpond (fish farming pond) with a length of 25 m and a width of 20 m. What are the area and perimeter of the farmer's land?
Answer**:**
………………………………………………………………………………….
………………………………………………………………………………….

(5) *Communicating*

In the communication activity, students are expected to present their findings and showcase them in front of a wide audience, thereby directing their courage and self-confidence. Other students can also provide comments, suggestions, or improvements regarding their peers. The steps involved in the communication activity were as follows: (a) Students, together with their group, read out their work in front of the class. (b) Each group listens attentively and may provide input or additions to the characters or the activities being discussed. (c) Each group took turns reading their group's work in front of the class. (d) After all groups have presented their work and received input from other groups, the teacher provides an explanation in front of the class.

Discussion

Ethnomathematics can create a fresh atmosphere for learning. In this instructional design, in addition to applying the principles of learning with a scientific approach, elements of local culture such as the "jaring bubu" (traditional fish trap) are incorporated as a medium to understand the concepts of area and perimeter of rectangles. The use of learning media derived from objects around students aligns with the characteristics of contextual learning, in which teachers bring the real world into the classroom and encourage students to connect their existing knowledge with its applications in everyday life.

Hosnan (2014) concluded that students learn better when the material studied is related to what they already know and to activities or events happening around them. The "jaring bubu" (traditional fish trap) is a tool made by the majority of fishermen and is already familiar to students living in coastal areas. Moreover, the "jaring bubu" design is a cultural heritage that has passed down from generation to generation. From birth until they attend elementary school, students absorb what exists in their environment, including observing and understanding the process of making "jaring bubu." Therefore, using "jaring bubu" as a teaching medium is highly effective, as the brain starts working from infancy or toddlerhood. This aligns with the findings of (Joyce et al., 2009).

The scientific or science-based approach aligns with constructivist theory, which views humans as active learners capable of developing their own knowledge. Schunk (2012) stated that from a constructivist perspective, teachers should avoid traditional teaching methods directed at a group of students. Instead, teachers should create situations that allow students to actively engage with subject matter through material processing and social interaction. Active engagement with the subject implies that the learning process involves two-way communication between the students and teachers. This instructional design adheres to the principles of constructivist learning as follows: (1) Teachers should present problems whose relevance becomes increasingly clear to students. (2) Learning should be organized around key concepts, meaning that teachers must design activities centered on groups of questions and conceptual problems, presenting ideas holistically rather than in isolation. (3) Discovering and respecting students' perspectives. (4) Adapt the curriculum to consider students' assumptions. (5) Assess students' learning within the context of instruction, meaning that assessment is integrated with teaching Schunk (2012).The scientific approach also aligns with Vygotsky's theory, which emphasizes that learning and development cannot be separated from their context, as the way students interact with their world (including people, objects, and institutions) transforms their way of thinking.

Children learn about culture and various other diversities within their family and community environments from a very young age, even as infants do. According to Piaget's developmental theory, elementary school-aged children are in the concrete operational stage, during which they can reason logically, as long as the reasoning can be applied to concrete examples. Since mathematical thinking is a logical process and the cognitive development of elementary school children is at the concrete operational stage, they will only think logically if mathematical problems are presented concretely. In this instructional design, the teacher introduces the "jaring bubu" (traditional fish trap) as a direct learning medium to help students better understand the concepts of area and perimeter of rectangles. Through this medium, mathematical problems can be presented concretely rather than immediately in abstract form. Thus, the mathematics learning process in this instructional design aligns with students' cognitive developmental stages.

The scientific approach can be viewed as a learning method that prioritizes students' exploratory processes in discovering concepts through scientific methods, similar to those of a researcher. The flow of learning, starting from observing, questioning, gathering data, associating/reasoning, and communicating, can shape students' thinking frameworks as sensitive, logical individuals with a strong sense of curiosity. Assuming that this approach is implemented effectively, students who receive learning through a scientific approach will later grow into excellent individuals.

Learning using a scientific approach based on ethnomathematics refers to teaching that uses a scientific approach while incorporating local cultural elements into the learning process. The local culture in question can include mathematical terms commonly used in certain communities such as measurements, arts, traditions, unique objects, traditional foods, and other distinctive aspects of the region. By combining the scientific approach, as a formal part of the government curriculum, with local cultural elements containing mathematical aspects, classroom learning is expected to become more effective, avoiding monotony and boredom for students.

Conclusions and Recommendations

Conclusions

Based on the above analysis, the following conclusions can be drawn about this scientific learning design based on ethnomathematics:

1. The scientific approach aligns with the characteristics of 21st-century learning, which emphasizes student-centered, enjoyable, meaningful, and contextual learning.
2. Ethnomathematics can create a fresh atmosphere for mathematics learning because it allows students to study mathematics based on what they already know and through activities or events happening around them.
3. The scientific approach based on ethnomathematics corresponds to Piaget's developmental theory, in which elementary school-aged children are in the concrete operational stage. By using

the "jaring bubu" (traditional fish trap) as a medium to understand the concepts of area and perimeter, mathematical problems can be made more concrete.

Recommendation

It is hoped that future researchers will investigate the design of scientific learning approaches based on ethnomathematics for the perimeter and area of rectangles, using the same methods as this study.

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