



Ethnomathematics Exploration of Dayak Agabag Weaving Culture and the Perceptions of Vocational High School Teachers and Students

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Abstract

The exploration of ethnomathematics in various cultural communities in Indonesia has been widely conducted by previous researchers. However, relatively few publications have reported ethnomathematical explorations of the Dayak *Agabag* community. Therefore, this study aimed to: (1) explore the mathematical concepts embedded in Dayak *Agabag* woven motifs, (2) mapping these mathematical concepts onto formal mathematics, and (3) explore the perceptions of vocational high school (SMK) teachers and students regarding the use ethnomathematics of Dayak *Agabag* as a context for mathematics learning. This study employed a qualitative approach using ethnographic methods. Data were collected through observations, interviews, and documentation analysis. The research informants consisted of one traditional leader, two weaving artisans, three vocational high school students, and three vocational high school teachers. The collected data were subsequently reduced, presented in narrative form, and analyzed using the Interactive Analysis Model. The findings showed that the woven mat featuring the Bintang Timur motif incorporates the mathematical concepts of kites, rhombuses, translations, and reflections. The *Sinumandak* woven mat incorporates the concepts of angles, vertically opposite angles, circles, and parallelograms. The *Binangkawot* woven mat incorporates the concept of a circle inscribed within a rhombus. Meanwhile, the *Kalawang* woven bag incorporates the concepts of parallel lines, isosceles triangles, and right triangles. Furthermore, vocational high school mathematics teachers stated that the use ethnomathematics of Dayak *Agabag* in mathematics learning can make learning more contextual, has the potential to increase students' motivation, and encourages students to reflect on the role of mathematics in everyday life

Keywords: Ethnomathematics, Weaving, mathematical Concepts, students dan teachers perception

Abstrak

Eksplorasi etnomatematika dalam berbagai budaya masyarakat di Indonesia telah banyak dilakukan oleh peneliti terdahulu, namun belum banyak publikasi yang melaporkan hasil eksplorasi etnomatematika pada masyarakat Dayak Agabag. Oleh karena itu, penelitian ini dilakukan dengan tujuan: (1) mengeksplorasi konsep-konsep matematika yang terdapat pada motif anyaman Dayak Agabag, (2) memetakan konsep matematika tersebut ke dalam matematika formal, dan (3) mengeksplorasi persepsi guru dan siswa sekolah menengah kejuruan (SMK) mengenai penggunaan etnomatematika Dayak Agabag sebagai konteks dalam pembelajaran matematika. Penelitian ini menggunakan pendekatan kualitatif dengan metode etnografi. Data dikumpulkan melalui observasi, wawancara dan analisis dokumentasi. Informan penelitian terdiri atas satu tokoh adat, dua orang pengrajin anyaman, dan tiga orang siswa SMK, dan tiga

orang guru SMK. Data yang terkumpul kemudian direduksi, disajikan dalam bentuk teks naratif, dan dianalisis menggunakan Model Analisis Interaktif. Hasil penelitian menunjukkan bahwa tikar anyaman dengan motif Bintang Timur memuat konsep layang-layang, belah ketupat, translasi, dan refleksi. Tikar anyaman Sinumandak memuat konsep sudut, sudut berseberangan, lingkaran, dan jajar genjang. Tikar anyaman Binangkawot memuat konsep lingkaran yang terdapat di dalam belah ketupat. Sementara itu, tas anyaman Kalawang memuat konsep garis sejajar, segitiga sama kaki, dan segitiga siku-siku. Selain itu, guru matematika SMK menyatakan bahwa penggunaan etnomatematika Dayak Agabag dalam pembelajaran matematika dapat membuat pembelajaran menjadi lebih kontekstual, berpotensi meningkatkan motivasi siswa, serta mendorong siswa untuk memikirkan peran matematika dalam kehidupan sehari-hari.

Kata Kunci: Ethnomathematics, Anyaman, Konsep Matematika, Persepsi siswa dan guru SMK.

1. INTRODUCTION

Mathematics learning in vocational schools is often perceived as abstract and disconnected from students' cultural experiences or relevance to their vocational fields. As a result, students tend to struggle to understand mathematical concepts meaningfully and connect them to real-life situations. Whereas, if students' social and cultural values are encouraged and supported in the mathematics classroom, through the use of context, through the recognition of personal paths and directions, then their learning will be more meaningful to them (Boaler, 1993a). It is further stated that their social, cultural, personal, "folk" or "ethnic" mathematics will receive better mathematical recognition in the social environment, and this in turn will allow connections to be made with mathematics in the classroom that can make this more meaningful when students faced with real-world demands. This aligns with the statement that classrooms and learning environments cannot be separated from the communities in which they exist (Rosa & Orey, 2011b). Several of these statements emphasize the importance of context in mathematics learning in the classroom. This means that in the process of helping students understand mathematical concepts, a context relevant to their daily lives is needed.

Mathematics learning in vocational schools is often perceived as abstract and disconnected from students' cultural experiences or relevance to their vocational fields. As a result, students tend to struggle to understand mathematical concepts meaningfully and connect them to real-life situations. If students' social and cultural values are encouraged and supported in the mathematics classroom - through the use of context and through the recognition of personal paths and directions - then their learning will be more meaningful to them (Boaler, 1993b). It is further argued that their social, cultural, personal, "folk," or "ethnic" mathematics will receive better mathematical recognition in the social environment, which in turn will allow connections to be made with classroom mathematics, making it more meaningful when students are faced with real-world demands. This aligns with the view that classrooms and learning environments cannot be separated from the communities in which they exist. These statements collectively

emphasize the importance of context in mathematics learning. This means that in the process of helping students understand mathematical concepts, a context relevant to their daily lives is needed.

Many mathematical concepts learned in class are related to objects around students. Observation of these mathematical objects is then followed by a process of analysis, abstraction, and generalization. This is in line with the view that concept formation begins with an analysis of the representation of the situation outside the object being studied, followed by processes of analysis, abstraction, and generalization (Morales-Carballo et al., 2024). The conceptual structure of mathematics can be related to several components, such as distinctions, relations, abstractions, and generalization (Jost, 2015). Therefore, objects around us can be connected to formal mathematical concepts learned by students in mathematics class. Generalized concepts of objects indicate classes of real or ideal objects, which can be characterized through representations - for example, the concepts of triangles, quadrilaterals, angles, numbers, and so on (Morales-Carballo et al., 2024).

Referring to the process of forming mathematical concepts from objects around us, it is reasonable to suggest that mathematical concepts exist in every culture. Because each person develops in different institutions and cultural environments, the psychological processes involved in understanding linguistic or conceptual objects of mathematics are mediated by institutional meanings - namely, problem-situations, semiotic instruments, customs, and shared conventions (Godino, 1996). Furthermore, mathematics in various cultures can be introduced to students to provide them with rich background knowledge, which will help them share the results created by people from all ethnic groups, appreciate mathematical achievements across different cultural traditions, and understand how calculating tools influence mathematics and the daily lives of society (Zhang & Zhang, 2010). This suggests that mathematics learning can be meaningfully connected to culture. In this context, ethnomathematics becomes highly relevant to the study of mathematical concepts found in cultural practices.

The introduction of ethnomathematics studies serves as a bridge that strengthens the use of the noble cultural values of society in mathematics learning. Ethnomathematics provides enrichment and new topics that students have never encountered before, showing that applications of mathematics can be found not only in many fields of science, business, and everyday life, but also in cultural practices around the world (Rosa et al., 2016). Ethnomathematics is also recognized as a field of study and research in mathematics education (Favilli, 2004). Related to this, practices such as counting, measuring, classifying, ordering, inferring, and modeling, among others, form the basis of ethnomathematics (D'Ambrosio, 1985).

The existence of ethnomathematics is highly relevant to the diverse and culturally rich context of Indonesian society. Various ethnomathematics studies have been conducted to explore mathematical concepts in culture. Such explorations have been conducted at the Deli Serdang Museum (Arfianda et al., 2024), the Medan State Museum (Fadilah & Khayroiyah, 2024), and the Banyumas Joglo house (Setyaningrum & Untarti, 2024). Ethnomathematics explorations have also been conducted on weaving crafts, uncovering concepts of lines and geometry (Adelia & Sarassanti, 2025; Nina, 2021), spatial geometry and geometric transformations (Aulia & Komalasari, 2025; Taneo et al., 2025), and the concepts of arithmetic sequences and equivalent ratios (Sewa et al., 2023).

Similar to other regions, ethnomathematics exploration in Dayak culture has been carried out extensively, both in weaving crafts and other artifacts. These include explorations in Dayak Taman weaving (Beatrix, 2023), Dayak communities on the border of West Kalimantan and Malaysia (Hartoyo, 2013), and the Dayak Jangkang community (Ellissi & Liliana, 2023). Ethnomathematics explorations of carved artifacts have been conducted in Dayak Kenyah culture (Darmayasa et al., 2022) and on *Bening* Dayak Kenyah artifacts (Darmayasa et al., 2023). The results of these various explorations show that weaving crafts, carvings, and other artifacts, as works of art, are objects related to mathematical concepts. The beauty of woven motifs demonstrates the interconnectedness between art and mathematics. This relationship is reflected in Kaz Maslanka's artwork, which integrates poetic elements into the structure of mathematical equations and situates the resulting equation-poems within a visual environment that captures and reinforces their meaning (Glaz, 2011)

The existence of various ethnomathematics studies contributes to the development of mathematics learning, as ethnomathematics research can consistently support the preservation of culture and the advancement of technology and art through education. In the context of vocational schools, culturally contextualized learning can help students view mathematics as something more relevant to their daily and social experiences. However, among the various ethnomathematics studies mentioned above, none has explored the mathematical concepts embedded in the woven motifs of the Dayak Agabag people. Furthermore, most of these studies primarily focus on identifying mathematical concepts in cultural artifacts without examining how these cultural contexts are understood by teachers and students as potential sources for mathematics learning. Studies involving Dayak Agabag culture remain very limited, particularly in the context of vocational education, and there is still insufficient understanding of how teachers and students respond to the use of Dayak Agabag cultural contexts in mathematics learning. Therefore, this study aims to explore the elements of ethnomathematics embedded in the culture of the Dayak Agabag community and to investigate teachers' and students' perceptions regarding the use of this cultural context in vocational mathematics learning.

2. METHODS

This study employed a qualitative approach to explore ethnomathematics in Dayak Agabag culture and to examine the perceptions of vocational high school teachers and students regarding the use of Dayak Agabag ethnomathematics as a context in mathematics learning. Therefore, the information collected to answer the research questions is in the form of qualitative data (Pandey & Pandey, 2015). Taking into account the research objectives and the cultural group in which the research was conducted, the ethnographic method was employed. Through the ethnographic method, researchers can describe, explain, and analyze the cultural elements of a community, particularly the Dayak Agabag community

The research was conducted in North Kalimantan, Indonesia, from October 2023 to March 2024. To obtain optimal data, research subjects were selected using a purposive sampling technique, taking into consideration their knowledge, expertise, and involvement in traditional activities, particularly weaving. The research subjects included one traditional leader, two weaving craftsmen, three students of SMK Negeri 1 Tulin Onsoi, and three mathematics teachers from three different vocational high schools in North Kalimantan. The demographics of the research informants are presented in Table 1.

Table 1. Demographics of the Research Informants

Informant*	Informant Code	Gender	Role
Bsw	S1	Male	Dayak Agabag Traditional Figure
Stl	S2	Female	Weaving Craftsman
Ijl	S3	Female	Weaving Craftsman
Chd	S4	Male	Vocational High School Student
Anie	S5	Female	Vocational High School Student
Latie	S6	Female	Vocational High School Student
Umr	S7	Male	Mathematics Teacher of Vocational High School
Yhp	S8	Male	Mathematics Teacher of Vocational High School
Anp	S9	Female	Mathematics Teacher of Vocational High School

**All informants' names are initials or pseudonyms to ensure anonymity.*

Bsw is a traditional figure of the Dayak Agabag community in Kalunsayan Village, Nunukan Regency. He has experience in protecting and preserving Dayak Agabag culture, including weaving crafts. Stl and Ijl are two members of the Dayak Agabag community with over ten years of experience as weavers. They weave mats, Kalabang bags, and "budui" vegetable bags. Chd, Anie, and Latie are students of SMK Negeri 1 Tulin Onsoi who have experience studying mathematics at the school. Regarding the three vocational high school mathematics teachers who participated, the following provides a description of each teacher's background. Umr is a mathematics teacher who

has taught at a vocational high school in Nunukan Regency since 2014. Umr has experience as a vice principal for curriculum and is active in self-development, including developing innovations related to mathematics learning. Yhp is a mathematics teacher at a vocational high school in Malinau Regency. He has been teaching mathematics since 2009 and has experience teaching students in grades 10, 11, and 12 at the vocational high school level. Lastly, Anp is a mathematics teacher at a vocational high school in Bulungan Regency. Anp has nearly ten years of teaching experience and actively pursues self-development in mathematics teaching, including participating in mathematics training activities aligned with curriculum developments.

The instruments used in this study include key and supporting instruments. All authors served as key instruments in this study. The first author, acting as the key instrument, observed the weaving process, interviewed traditional figures and weavers, and interviewed students. Meanwhile, the second and third authors conducted interviews regarding the perceptions of vocational high school mathematics teachers. To facilitate the research process, supporting instruments were also developed, including interview guidelines and observation sheets.

Data collection was conducted through observation, interviews, and document analysis (Creswell, 2009). The first author served as the key instrument in this study and used supporting instruments in the form of an ethnomathematics observation sheet and interview guidelines developed jointly with the second and third authors. Observations were made of the weaving process carried out by the craftsmen, as well as of the woven motifs that had been produced. To increase the validity of the data, interviews were then conducted with Dayak Agabag traditional leaders who have experience, knowledge, and skills related to weaving and its motifs. Semi-structured interviews were also conducted with three students of SMK Negeri 1 Tulin Onsoi and three mathematics teachers of vocational high schools to obtain data related to their views on the use of Dayak Agabag culture as a context for mathematics learning. The students selected as informants were those with strong mathematical abilities, and their selection involved recommendations from mathematics teachers at the relevant schools. The following is an example of an interview excerpt with students and its breakdown into cultural themes.

In addition to observations, interviews, and document analysis, photographs of woven motifs were also taken as research data. This was done because photographs provide highly descriptive data, which are often used to understand subjective matters and are frequently analyzed inductively (Bogdan & Biklen, 2006).

The collected data were then reduced, presented in narrative text, and analyzed using the Interactive Analysis Model (Miles et al., 2014). Data validity was assessed through credibility, confirmability, dependability, and transferability tests (Sugiyono, 2013). Credibility testing was conducted by ensuring that research findings were not drawn from

only one data collection technique. Source triangulation and time triangulation were conducted by comparing data from various sources and at different time points to ensure the consistency and validity of the findings. For dependability, the researcher ensured that all research data were obtained through observation, interviews, document analysis, and photography. The confirmability process was carried out through rechecking by the second and third authors. To support transferability, the research results were written in as much detail as possible. All of these processes ensure data accuracy and increase confidence in the findings of this ethnomathematics research on Dayak Agabag culture.

3. RESULT AND DISCUSSIONS

Mathematical concepts in Agabag Dayak Weaving

The Dayak Agabag in Nunukan Regency, North Kalimantan Province, are a cultural group whose culture has been passed down from generation to generation as part of their identity. Similar to other cultural groups, they produce artifacts as a manifestation of their thoughts and creativity. Weaving in the form of mats and everyday tools is the focus of this research.

Based on the results of observations, there are geometric shapes that are used as motifs in the weaving. According to the results of interviews with traditional leaders and craftsmen, geometric shapes were chosen as weaving motifs because of their regular and patterned shapes, so they have artistic value and are easy to shape. The following are 4 (four) Dayak Agabag weaving crafts that have been inventoried as a result of exploration along with the mathematical concepts contained in the resulting motifs and the perceptions of high school students regarding the use of the culture as a context in mathematics learning.

A. Woven Mat

Woven mats are produced by artisans as household items for the Dayak Agabag people. The creativity of the mat weavers can be seen in the motifs they create. Three distinct motifs have been identified, including:

1. *Bintang Timur* motif and its mapping with school mathematics

Two colors of rattan are used in the woven *Bintang Timur* motif. The weaving pattern creates geometric shapes that are neatly arranged and visually pleasing. The resulting motif also exhibits a visual pattern that is fluid, regular, and distinct. Below is a photo of the motif in the *Bintang Timur* weave. It applies the concept of flat geometry with a regular arrangement and pattern.



Figure 1. Bintang Timur motif

From the image above, we can observe geometric motifs, namely kites and rhombuses. Kites and other flat geometric shapes are arranged in such a way that they produce regular polygons. The arrangement of the flat shapes of kites in several patterns represents different mathematical concepts, namely transformation geometry (translation or reflection), proportion, and symmetry. The integration of the concepts of kites, translation, reflection, proportion, and symmetry contributes to the artistic value of the work. This artistic value is certainly an added value beyond the main function of the mat as a sitting mat.

2. The *Sinumandak* (beautiful girl) motif and its mapping with school mathematics

The woven mat with the *Sinumandak* motif displays a neat, repeating geometric pattern. A thorough examination reveals the dominant application of mathematical concepts: parallel lines, angles, circles, and parallelograms. For more clarity, see the following image.

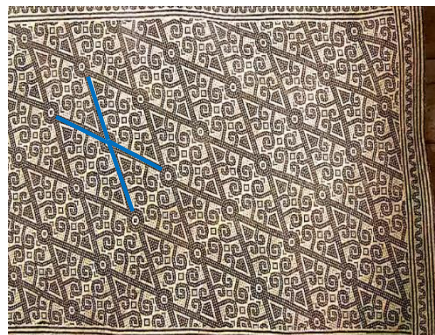


Figure 2. Tikar Motif *Sinumandak*.

Figure 2 shows that the craftsman arranged the motif to represent a geometric shape in the form of a parallelogram. The craftsman arranged the motif in the form of a parallelogram and repeated the pattern diagonally.

Then, the four corners of the parallelogram overlap, forming a motif that represents two opposing angles. The collection of interconnected geometric shapes creates a beautiful and aesthetically pleasing work.

3. *Binangkawot* motif and its mapping with school mathematics

The woven mat with the *Binangkawot* motif displays a simpler pattern than the previous two. The dominant geometric shape observed in the *Binangkawot* motif is a circle within a rhombus. This motif repeats sideways and diagonally to the upper right or lower right. For clarity, Figure 3 shows it as part of a geometric transformation, specifically translation. Translation in this context refers to the repetition of a pattern or motif on a flat surface, where each part of the pattern is moved to a new position without changing its orientation or size.

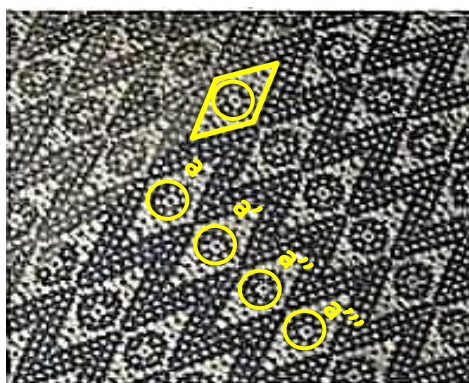


Figure 3. Mat with *Binangkawot* motif

B. “*Kalawang*” Bag

The *Kalawang*, a type of bag used by the Dayak Agabag people is used for various purposes. It has a unique design and is often used in various traditional ceremonies. The *Kalawang* incorporates mathematical concepts of plane figures, namely isosceles triangles, right triangles, and parallel lines. The mathematical principles of this weaving can be seen in the repetition of the patterns and the symmetry within the design. The mathematical procedures in this weaving involve steps from pattern formation to calculations to determine the amount of material needed, as well as balance and symmetry, to create a beautiful work.



Figure 4. Motif on *Kalawang*

C. Bag for vegetables and harvest “Budui”

Budui, a weaving tool used by the Agabag Dayak people, is used as a storage container for vegetables and rice harvests. Budui, with its busak motif, incorporates the mathematical concept of rhombuses and squares, which are formed based on the pattern and calculation of the rattan used. The mathematical procedure for this weaving involves a sequence of steps to create these patterns, including counting the number of weave points, or measuring the length and width of the woven material to ensure the pattern is formed correctly. In the woven motifs produced in Budui, artisans strive to present plant-like ornaments, complete with stems, leaves, and fruit. Craftsmen choose lines to depict stems, circles and closed curves to depict leaves, and rhombuses to depict fruit. These geometric shapes create artistic and orderly woven motifs. Craftsmen also repeat similar motifs sideways with great precision, both in terms of size and shape (Figure 5).

Figure 5. Motif on *Budui*

Mapping Cultural Practices to School Mathematics

The mathematical concepts, procedures, and principles found or applied in the manufacturing process and final products of Dayak Agabag weaving play a crucial role in mathematics learning. As described in the previous section, craftspeople choose geometric shapes such as lines, angles, triangles, squares, rhombuses, parallelograms, and circles as art forms to enhance the weaving. These geometric shapes are formed through the arrangement of two different colors of rattan: light and dark. In school mathematics lessons, these geometric shapes are usually related to area or perimeter. The position of two lines, for example, two parallel lines, is also studied in mathematics education. Furthermore, the woven motif also shows a geometric shape in the form of two rhombuses aligned diagonally. This pattern in mathematics learning is related to the relationship between two angles, namely opposite angles.

After selecting a geometric shape to depict the desired motif, the craftsmen tend to repeat the motif while maintaining its shape and size. This practice demonstrates the craftsmen's efforts to maintain harmony and regularity in the pattern, either sideways or diagonally. This procedure, in mathematics learning, is more closely related to transformation geometry, particularly translation. If the shape is the same but the orientation is opposite, it is closer to the concept of reflection. This means that the mathematical concepts, procedures, or principles discovered or applied by the craftsmen can be mapped to mathematics learning. The mapping with school mathematics is presented in Table 2 below.

Table 2. Mapping of the ethnomathematics of Dayak Agabag weaving with school mathematics

Motifs on Weaving		Mathematical Ideas	School Mathematics Topics
Diagonal repetition	rhombus	Iterative pattern organization and spatial consistency	Geometric transformation
Circle in a rhombus		Proportional arrangement and spatial estimation	Two-dimensional shape
The motif pattern is in the opposite direction		Reflectional balance and transformational reasoning	Symmetry and reflection
Horizontal repetition	motif	Translation patterns and patterns generalization	Geometric transformation
Regularity of spacing	of weave	Informal measurement and proportional reasoning	Measurement and geometry

Vocational High School Students' and Teachers' Perceptions

The discovery of mathematical concepts in Dayak Agabag woven motifs can contribute to improving the quality of mathematics learning, while also contributing to cultural preservation through utilization. Therefore, interviews were conducted with vocational

high school teachers and students to determine their perceptions on using Dayak Agabag ethnomathematics as a context for mathematics learning.

Based on the results of interviews with 3 vocational high school mathematics teachers from 3 different schools, an overview was obtained regarding teaching experiences, feelings, knowledge of ethnomathematics, perceptions, and suggestions. Of the 3 teachers, one has been teaching for 17 years, one has been teaching mathematics for 12 years, and the other has only been teaching for 7 years. The three teachers teach in different specialty programs. The first teacher teaches in the Visual Communication Design and Building Modeling and Information Design departments. The second teacher teaches in the Food Crops and Horticulture Agribusiness and Plantation Crops Agribusiness departments. The third teacher teaches in the Mining Engineering and Heavy Equipment Engineering departments. They expressed enthusiasm for their profession as vocational high school mathematics teachers. However, the three teachers faced the same problem: the students' lack of basic mathematical skills (basic operations). Consequently, they often revisited foundational material when teaching advanced mathematics.

Furthermore, it was found that the three teachers knew about ethnomathematics, but did not have experience in conducting research on ethnomathematics or utilizing ethnomathematics in mathematics learning. Their perceptions regarding the use of Agabag Dayak woven ethnomathematics as a context for mathematics learning in vocational schools are presented in the following excerpt from the interview transcript between the researcher (R) and the subject (S):

- R : *"What is your perception if Ethnomathematics of the Dayak Agabag Weaving is used in vocational school mathematics learning?"*
- S7 : *"Good and has the potential to increase students' motivation to learn mathematics "*
- S8 : *" making mathematics more contextual"*
- S9 : *"Very interesting. Its use encourages students to recognize the role of mathematics in real life."*
- R : *"If Dayak Agabag ethnomathematics is used in mathematics learning in vocational schools, is it used at the beginning, middle, end of learning, or in learning assessments?"*
- S7, S8, S9 : *"At the begining"*

In Addition to their perceptions, they provided suggestions regarding the use of ethnomathematics in mathematics learning in vocational schools. The teachers suggested developing questions that address the context of ethnomathematics and developing a training program for the use of ethnomathematics in collaboration with the education office.

In addition to teacher perceptions, findings related to student perceptions were obtained as presented in the following interview transcript excerpt.

- R : "How do you feel when learning mathematics?. Are you excited, happy, scared, or something else?"*
- S4 : "Not enthusiastic sir"*
- S5 : "I'm scared, sir, because we don't understand yet, but suddenly we're asked to come forward to work on the blackboard."*
- S6 : "It's just so-so, sir, because it's not very interesting."*
- R : "Do you like math lessons?"*
- S4 : "Of course not sir, because it's difficult for me"*
- S5 : "It is normal, sir."*
- S6 : "Just standard, sir"*

Based on this information, the researcher continued the interview with students regarding ethnomathematics as a context for mathematics learning in schools. The following is an excerpt from the researcher's interview with students regarding this topic:

- R : "What do you think if one of the cultures, especially Dayak Agabag weaving, is used as a context for culture-based mathematics learning in schools?"*
- S4 : "I think it's good, sir, especially since it touches on local culture."*
- S5 : "It would be great, Sir, if it were used as a context for mathematics learning, especially when using real object"*
- S6 : "I think the use of culture, such as weaving in the Dayak Agabag, as a context for learning mathematics in schools has enormous potential, because it's not just about mathematics but also about introducing existing local cultural heritage."*

Interviews with students at SMK Negeri 1 Tulin Onsoi revealed that some students felt unmotivated, afraid, or simply indifferent to mathematics lessons. These feelings stemmed from various factors, including difficulty understanding the material and uninteresting teaching methods. One student found mathematics difficult, while another felt anxious about solving problems on the board without sufficient understanding. When asked about the application of Dayak Agabag ethnomathematics in mathematics learning, student responses showed a positive outlook. One student stated that integrating local culture, such as Dayak Agabag weaving, into mathematics learning was a good idea because it touched on local culture. Another student described this approach as 'great' because it involved tangible objects that could be seen and touched. Another student added that using Dayak Agabag culture in mathematics learning had great potential because it not only taught mathematics but also introduced local cultural heritage.

Students' perceptions of the integration of Dayak Agabag ethnomathematics into mathematics learning reveal several important implications. First, this approach can increase students' interest and motivation in mathematics by connecting the material to

real life and local culture. Second, providing cultural context in mathematics learning can help students understand that mathematics is part of everyday life and has broad applications. Third, the ethnomathematics approach supports more inclusive learning by respecting and incorporating cultural diversity into the curriculum.

Discussion

Dayak Agabag weavers create weaving patterns using geometric shapes such as triangles, squares, kites, rhombuses, and circles. When arranged into woven motifs, these geometric shapes exhibit regularity, symmetry, and beauty. These motifs demonstrate the integration of mathematics and art, reflected in the beauty of Dayak Agabag weaving.

Dayak Agabag weavers create weaving patterns using geometric shapes such as triangles, squares, kites, rhombuses, and circles. When arranged into woven motifs, these geometric shapes exhibit regularity, symmetry, and beauty. These motifs demonstrate the integration of mathematics and art, as reflected in the aesthetic quality of Dayak Agabag weaving.

Observations of the geometric shapes and the regularity of the weaving patterns reveal that craftsmen place geometric shapes proportionally. They do this informally, without the use of measuring tools, relying instead on visual observation of the weaving arrangement of each rattan strip. For example, in one motif, a circle is woven within a rhombus, positioned so that it does not touch the sides of the rhombus. The pattern also repeats itself, forming a regular arrangement. In this process, craftsmen rely on visual estimation to maintain geometric regularity and spatial consistency throughout the weaving. The placement of geometric shapes in Dayak Agabag weaving tends to follow a repeating sideways pattern while maintaining consistent size. This process reflects how craftsmen mentally organize repeated spatial structures and maintain motif continuity through informal transformational reasoning developed through cultural practice. These findings are consistent with those of (Dominikus et al., 2023), who found that various ethnomathematical characteristics in the weaving activities of the West Amarasi community indicate the existence, practice, and development of mathematical concepts and ways of thinking within a socio-cultural context.

The geometric shapes chosen by the craftsmen do not stand alone. Looking at the motifs on the Budui vegetable and harvest bag, for instance, craftsmen chose lines to represent stems, rhombuses to represent fruit, and closed curves to represent leaves. This combination of geometric shapes creates a pattern depicting a fruiting plant. This choice of geometric pattern appears to link the woven motifs to the Budui's function as a container for vegetables and harvested produce.

The geometric shapes chosen for woven motifs, the repetition of shapes in horizontal or diagonal orientations, and the appearance of similar shapes in opposite directions all

illustrate the craftsmen's mathematical thinking, as expressed through the motifs. Connected to school mathematics, the craftsmen have applied the concepts of plane figures, patterns, and transformation geometry. This practice reflects an appreciation for geometric shapes that exhibit regularity - such as the rhombus, which has adjacent sides of equal length and opposite angles of equal measure.

These findings have clear pedagogical implications for mathematics learning, including in vocational high schools. For example, students majoring in Visual Communication Design can use woven motifs as references when creating visual designs. Similarly, mathematics teachers can use these woven motifs as an introduction to relevant material. Furthermore, mathematics teachers can design contextualized learning experiences, guide learning through discovery, develop ethnomathematics-rich worksheets, or design culturally responsive learning - as expressed by one vocational high school mathematics teacher during the interview.

The findings regarding mathematical concepts in Dayak Agabag weaving thus have a significant role in advancing mathematics education and learning, particularly at the school level and in teacher education programs for prospective mathematics teachers. This aligns with the finding that teachers at SMP Negeri 1 Linggang Bingung, West Kutai, considered ethnomathematics-based learning to be highly necessary (Dimpudus & Ding, 2019). As previously presented, the mathematical concepts found in (Hidayatulloh & Hariastuti, 2018), Dayak Agabag weaving motifs include lines, angles, two-dimensional geometric shapes, and transformation geometry. These findings are consistent with those from studies on Rajapolah woven crafts (Prabawati, 2016), ethnomathematics exploration of Banyuwangi Paglak Angklung, explorations of various motifs of Sambas Malay songket woven cloth (Panjaitan et al., 2021), and explorations of rattan woven crafts in the Gresik community (Wurdani & Budiarto, 2021).

The use of Dayak Agabag weaving ethnomathematics in mathematics learning should be adapted to appropriate content areas, and the competencies being developed need to be adjusted accordingly - for example, to improve students' mathematical literacy skills. The findings of this study align with the context of shape and space, as also found in research on the Pancaniti construction (Umbara et al., 2023). This is further supported by (Fitri et al., 2025), who found that integrating local cultural contexts into mathematics assessments improves students' contextual validity and higher-order thinking skills. The findings can also be used to develop ethnomathematics-based textbooks or as a context for developing Academic Ability Test (TKA) questions. The importance of ethnomathematics-based textbooks is highlighted by (Chasanah et al., 2024), who found that 171 out of 180 (95%) junior high school students in Magelang agreed with the development of such materials.

4. CONCLUSION

Ethnomathematics in Dayak Agabag weaving, particularly in the motifs of mats, *Kalawang* bags, and Budui daily use items contains geometric shapes that correspond to several mathematical concepts. Woven mats with the Bintang Timur motif correspond to the concepts of kites, rhombuses, translations, and reflections. Woven mats with the *Sinumandak* motif correspond to the concepts of angles, opposite angles, circles, and parallelograms. Woven mats with the *Binangkawot* motif correspond to the concept of a circle within a rhombus. Woven bags with the *Kalawang* motif correspond to the concepts of parallel lines, isosceles triangles, and right triangles. In addition, the repeating motifs including rhombus repetitions, circles within rhombuses, motifs with the same shape in opposite directions, horizontal motif repetitions, and similar shapes repeated at regular intervals - contain mathematical ideas that can be mapped to school mathematics topics. Accordingly, several school mathematics topics that correspond to Dayak Agabag woven motifs include transformation geometry, plane figures, symmetry and reflection, as well as measurement and geometry.

Furthermore, the geometric shapes found in Dayak Agabag weaving can serve as a medium for observation prior to introducing relevant mathematical concepts. Similarly, pictures of culturally relevant objects are often used to introduce mathematical word problems. Therefore, the findings of this study can contribute to mathematics learning and motivate students to engage with mathematics - particularly in relation to plane figures, the area of plane figures, reflection, and translation.

6. RECOMENDATION

This research is limited to the exploration of ethnomathematics in Dayak Agabag weaving and the perceptions of vocational high school teachers and students regarding its use in mathematics learning. The study did not further explore its direct application in classroom learning. Therefore, several recommendations for future research are proposed: researchers may utilize the mathematical concepts found in Dayak Agabag weaving to design task-rich worksheets, referred to as ethnomathematics-rich worksheets; researchers may also investigate students' mathematical thinking processes when learning takes place using cultural contexts such as this.

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