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Entomathematical Study of Typical *Base'k* and *Raga'k* Woven of the Dayak Bidayuh Community, Bengkayang Regency

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Abstract

Ethnomathematics exploration content especially in Base'k and Raga'k handwovens can be used as contextual teaching materials in learning mathematics in various subject matter of mathematics, based on pre-research information showed that this optimization had not materialized. This research method was descriptive qualitative with an ethnographic approach whose application is aimed at identifying ethnomathematics and any mathematical concepts contained in the activity of weaving Base'k and Raga'k Typical of the Dayak Bidayuh Community, Bengkayang Regency. The results of the study showed that the mathematical concepts contained in the Base'k and Raga'k woven are typical of the Dayak Bidayuh community, Bengkayang Regency, namely; In the counting activity, there is the concept of addition and multiplication operations on integers and the concept of equivalent comparison. In the measure activity, there are the concepts of measurement, area, geometry and linear programming. In the locating activity there are the concepts of probability and set. In the designing activity there is the concept of Geometry Transformation. In playing activities, there is the concept of number patterns. In the explaning activity, there is the concept of a number line.

Keywords: *base'k and raga'k webbing, culture of the dayak bidayuh community; ethnomatematics studies*

Abstrak

Konten eksplorasi etnomatematika khususnya anyaman *Raga'k* dan *Raga'k* dapat dijadikan sebagai bahan ajar kontekstual dalam pembelajaran matematika di berbagai mata pelajaran matematika, berdasarkan informasi pra penelitian menunjukkan bahwa optimalisasi tersebut belum terwujud. Metode penelitian ini adalah deskriptif kualitatif dengan pendekatan etnografi yang penerapannya bertujuan untuk mengidentifikasi etnomatematika dan konsep matematika apa saja yang terdapat dalam kegiatan menenun *Raga'k* dan *Raga'k* Khas Masyarakat Dayak Bidayuh Kabupaten Bengkayang. Hasil penelitian menunjukkan bahwa konsep matematika yang terdapat pada anyaman *Raga'k* dan *Raga'k* merupakan ciri khas masyarakat Dayak Bidayuh Kabupaten Bengkayang yaitu; Dalam kegiatan berhitung terdapat konsep operasi penjumlahan dan perkalian pada bilangan bulat dan konsep perbandingan senilai. Dalam kegiatan pengukuran terdapat konsep pengukuran, luas, geometri dan pemrograman linier. Dalam kegiatan locating terdapat konsep probabilitas dan himpunan. Dalam kegiatan perancangan terdapat konsep Transformasi Geometri. Dalam kegiatan bermain terdapat konsep pola bilangan. Dalam kegiatan menjelaskan terdapat konsep garis bilangan.

Kata Kunci: anyaman *raga'k* dan *raga'k*; kajian etnomatematika; kebudayaan masyarakat dayak bidayuh

INTRODUCTION

The connection between society and cultural elements is very close, considering society as a resource that plays a role in conserving cultural values so that they remain sustainable and become an attraction for areas that have these cultural values. Humans and culture are an inseparable unit, while the supporters of culture are human beings themselves (Normina, 2017; (Ridhani, 2014). According to Tylor in (Liliweri, 2014); (Nafi'a and Muhid, 2021), culture is a complex collection of knowledge, beliefs, arts, laws, morals, customs and any other capabilities or habits acquired by humans as members of society. Herskovits in (Setiadi, 2012); (Setianingsih, 2019), states that everything contained in society is determined by the culture that belongs to the community itself. The idea of culture in the context of science requires the right media in the process of conveying this information. School as a strategic tool for the exchange of information related to the nature of culture and its impact on knowledge.

In the context of learning mathematics, cultural elements can be identified in the application of mathematics in everyday life. The concept holds that ethnomathematics is mathematics used within identifiable cultural groups. (Prabawati, 2016; Hidayati and Prahmana, 2022), ethnomathematics is mathematics that is practiced among identified cultural groups such as society, ethnicity, labor groups, children from certain groups and professionals. Furthermore, according to (Hartoyo, 2011; Panjaitan, et al., 2021), ethnomathematics is a complex and dynamic representation that describes the cultural influence of the use of mathematics in its application. The statement shows that mathematical elements can be identified in certain cultural elements, including traditional skills.

The essence of mathematics in general leads to numbers, shapes and patterns whose applications can be found in everyday life. These components are relevant to be found in cultural products including traditional crafts. Based on previous research conducted by (Ayu, et al., 2020; Ibrahim, 2021), relating to ethnomathematics studies on the activities of the Sejangkung bamboo woven craftsmen, it was identified that there is a mathematical content in the activities of the woven bamboo craftsmen of the Sejangkung community, including, counting activities contain the concept of set, the concept of logic, the concept of comparison of value, the concept of comparison, geometric concept, number pattern concept, geometric transformation concept, and integer multiplication concept. Furthermore, the measuring activity contains the concept of measurement, the design activity contains the concept of folding symmetry, and determining the location contains the concept of distance.

Relevant research conducted by Jesica Dwi Prananda (2020) entitled "Ethnomatematics Exploratory Study of Sape Musical Instruments in the Culture of the

Kalimantan Dayak Society" found that in the process of making the Sape musical instrument there is activity of measuring, the process referred to is, measuring the length of the body of the Sape , measuring the width of the Sape body, and measuring the thickness of the Sape body. Maryani et al (2022) entitled Ethnomathematical Studies in Kampung Adat Pulo Community Marriages that in locating activities there is a time calculation to find the auspicious day of marriage using the cardinal directions and the location of the groom's and bride's residence. Maryani et al (2022) entitled Ethnomathematical Studies in Kampung Adat Pulo Community Marriages that in locating activities there is a time calculation to find the auspicious day of marriage using the cardinal directions and the location of the groom's and bride's residence.

Based on facts in the field obtained by researchers regarding the existence of young people in weaving activities held in creative villages in Jagoi Kindau Hamlet, Sekida Village, Jagoi Babang District, West Borneo, Indonesian. Researchers obtained information from Mrs. Fitri Nurjanah (36 years) as Chair of the Empowerment and Family Welfare Driving Team (TP PKK) Sekida Village that the lack of enthusiasm from young people or from students in weaving activities. This raises concerns about the preservation of *Base'k* and *Raga'k* handwovens which are part of the handicrafts in this activity. In the interview process conducted, the researcher also sought information related to the connectivity between the weaving activities carried out and the use of schools as a means of preserving *Base'k* and *Raga'k* hand-woven. The information obtained by the researcher has no indication that it leads to learning activities at school or there have been no instructions received by the TP PKK Sekida Village from stakeholders to include elements of woven products either in learning. The involvement of mathematical content in *Base'k* and *Raga'k* handwovens in particular, ethnomathematics concepts in general in learning have a high level of relevance to the demands of the Independent Curriculum which has the characteristics of implementing project-based learning (Susilawati, 2021; Zunaidi, et al., 2021).

Base'k is a large woven rattan basket, while *Raga'k* is a small woven rattan bag or shopping bag. Concretely it can be explained that the follow-up of the exploration of ethnomathematics content, which in the context of this research on *Base'k* and *Raga'k* handwovens can be used as contextual teaching materials in everyday life in learning mathematics in various mathematical subject matter given the output in research is directed at exploring mathematical content in various materials and sub-mathematical materials, technically this can be loaded as teaching materials that are presented or as scaffolding in providing stimuli that can trigger students' conceptual understanding and critical thinking. The research objective in this study in general was to conduct an ethnomathematics exploration of the *Base'k* and *Raga'k* Typical Skills of the Dayak

Bidayuh Community, Bengkayang Regency. While specifically the objectives of this research are: To describe the ethnomathematics and any mathematical concepts contained in the Typical *Base'k* and *Raga'k* weaving activities of the Dayak Bidayuh Community, Bengkayang Regency (Astuti, et al., 2019; Armanto, et al., 2021).

Figure 1. *Base'k*

Figure 2. *Raga'k*

METHODS

This research can be classified into the type of qualitative research. This research method is descriptive qualitative with ethnographic approach. Researchers conducted interviews, observations, and documentation on *Base'k* and *Raga'k* weaving activities with reference to six ethnomathematics activities according to Bishop (in Lean, 1994), namely counting, measuring, locating, designing. designing), explaining (explanation), and playing (playing) which are used as indicators to carry out the process of identifying mathematical elements that exist in ethnomathematics activities that exist in the typical skills of the Dayak Bidayuh community, namely *Base'k* and *Raga'k.* The research location is in Jagoi Kindau Hamlet, Sekida Village, Jagoi Babang District, West Borneo, Indonesian. The informants in this research are indigenous elders and practitioners of weaving *Base'k* and *Raga'k.*

RESULT AND DISCUSSION

Result

Historically, wicker has appeared since the time of the ancestors of the Dayak Bidayuh Jagoi Babang community whose products are used in everyday life such as in building houses, farming and preserving food. In the development of the existence of woven products, it is directed at the economic sector by mobilizing the creativity of Human Resources (HR) in the production process to strengthen the community's economy, besides that it is also part of efforts to conserve cultural values. The distribution of woven products, especially *Base'k* and *Raga'k*, has been expanded with the use of social media platforms, which the creative village of Jagoi Kindau is increasingly intensifying during and after the pandemic.

In general it can be explained that the stages in the process of making *Base'k* and *Raga'k* consist of preparing the material, followed by the weaving process, and the finishing process which is usually filled with coloring motifs. Philosophically, several motifs were identified that were used in weaving *Base'k* and *Raga'k* including the Lolos, *Boton Puni (Eye Punai), Koling Pokuh (Frond Shoots), Juli' Sogot, Batu and Dolod (Mountain) motifs*. Currently *Base'k* and *Raga'k* woven products are not only used in farming processes or as grocery containers but also accommodate other interests such as souvenirs that are usually consumed by tourists or as displays at exhibitions with product sizes that have been adjusted by craftsmen.

Discussion

The ethnomathematic activities found in the *Base'k* and *Raga'k* weaving processes are: counting activities that occur when calculating the number of products based on the size produced, calculating the amount of plaits produced in one production period, counting the number or number of stems, segments, and rattan blades. The measure activity that occurs when measuring the length and diameter of the rattan stem, measuring the width and thickness of the rattan blade, determining the time needed to prepare the rattan material, determining the area used when weaving, determining the size of the woven, determining the price of the woven product. Based on relevant research conducted by Agustin (2017) entitled Ethnomathematics Activities of Coffee Farmers in the Sidomulyo Jember Region as Teaching Materials for Student Project Sheets which states that there is a counting activity in the ethnomathematics activity making planting holes.

Locating activity, namely determining where to take rattan materials, determining the placement of rattan materials to be used, determining the placement of finished woven products. Designing activities occur when determining the basic shape of the woven, determining the various motifs of the woven. Playing activities occur when determining motif coloring techniques, determining specific rules and strategies related to weaving methods, determining marketing strategies for woven products. Based on relevant research conducted by Jesica Dwi Prananda (2020) entitled "Ethnomatematics Exploratory Study of Sape Musical Instruments in the Culture of the Dayak People of Kalimantan" it was found that in the process of making Sape' musical instruments there are measuring activities, the process referred to is, measuring the length Sape body, measure the width of the Sape body, and measure the thickness of the Sape body.

Explaning activity (explaining) namely determining the exact time background for taking rattan. Based on relevant research conducted by Maryani et al (2022) entitled Ethnomatematics Studies in Kampung Adat Pulo Community Marriages that the activity of determining the location (locating) is found in calculating the time to find the

auspicious day of marriage using the cardinal directions and the location of the candidate's residence groom and bride-to-be.

Identification of mathematical concepts in counting activities, namely in determining the number of products based on the sizes produced, the researchers identified 4 sizes produced by *Base'k* and *Raga'k* woven craftsmen. Mathematical concepts that can be identified in the activity of determining the number of products based on the size of the *Base'k* and *Raga'k* woven production are addition operations on integers. Based on the amount of plaits produced in one production period or within one month, the number of *Base'k* and *Raga'k* products produced by craftsmen can be calculated. The mathematical concept that can be identified in the activity of determining the amount of webbing produced in one period of production of *Base'k* and *Raga'k* webbing is the addition operation on integers. The use of the number of rattan sticks in weaving activities adjusts to the size of the webbing to be made, the larger the webbing size, the more rattan sticks used. The mathematical concept contained in the activity of determining the number or number of rattan sticks used in weaving *Base'k* and *Raga'k* is a comparison of value. In calculating the number of rattan segments, it can be done by counting the number of segments on one rattan stick, then multiplied by how many rattan sticks are used so that the whole rattan segment can be obtained, for example in one rattan stick there are 12 segments, and the number of rattan sticks used as many as 30 pieces, then to determine the number of rattan segments is equal to 12 x 30 = 360 rattan segments. The mathematical concept contained in the activity of determining the number or number of rattan segments used in weaving *Base'k* and *Raga'k* is the multiplication operation on integers. In calculating the number of rattan blades, it can be done by counting the number of blades produced on one rattan stick, then multiplied by how many rattan sticks are used so that the whole rattan blade can be obtained, for example in one stick can produce 4 rattan sticks, and the number of sticks 30 pieces of rattan are used, so to determine the number of rattan blades is equal to 4 x 30 = 120 rattan blades. The mathematical concept contained in the activity of determining the number or number of rattan blades used in weaving *Base'k* and *Raga'k* is a multiplication operation on integers.

Identification of mathematical concepts in measure activities, namely determining the length and diameter of the rattan rods used in the *Base'k* and *Raga'k* weaving activities. The length and diameter of the rattan sticks can be obtained by measuring each rattan stick used in weaving with a tape measure or ruler. The mathematical concept contained in the activity of determining the length and diameter of the rattan rods used in weaving *Base'k* and *Raga'k* is the concept of measurement. In determining the area of the area used in weaving activities, mathematical concepts related to area can be identified. In *Base'k* woven the lower surface is square and the upper surface is circular,

while in *Raga'k* woven the lower surface is rectangular and the upper surface is elliptical. . So to determine the surface area of the matting can use the concept of Geometry. In determining the price of woven products, it can be seen from the capital spent in the woven production process, so that from the set price, maximum profit can be obtained. The mathematical concept contained in the activity of determining the price of *Base'k* and *Raga'k* woven products is a linear program. Based on relevant research conducted by Jesica Dwi Prananda (2020) entitled "Ethnomatematics Exploratory Study of Sape Musical Instruments in the Culture of the Dayak People of Kalimantan" it was found that in the process of making Sape' musical instruments there are measuring activities, the process referred to is, measuring the length Sape body, measure the width of the Sape body, and measure the thickness of the Sape body.

Identification of the mathematical concept in the locating activity (location), namely in determining the place to take the available rattan, can be identified with a mathematical concept, namely the matter of opportunity. During the weaving preparation process, the craftsmen grouped the rattan materials to be used, then placed them in a place usually used to store rattan materials. The mathematical concept contained in the activity of determining the placement of the rattan material to be used in weaving *Base'k* and *Raga'k* is the set. Finished woven products are usually grouped by type of woven, then displayed in a place that is easy for buyers to see. The mathematical concept contained in the activity of determining the placement of finished *Raga'k* and *Raga'k* woven products is the Set.

Identification of mathematical concepts in designing activities, namely the basic shape of *Base'k* woven is square, while the basic shape of *Raga'k* woven is rectangular. The mathematical concept contained in the activity of determining the basic shape of *Base'k* and *Raga'k* woven is Geometry. There are several kinds of woven motifs on *Base'k* and *Raga'k* namely including the Lolos, *Boton Puni (Eye Punai), Koling Pokuh (Frond Shoots), Juli' Sogot, Batu and Dolod (Mountain) motifs*. From some of these motifs can be identified mathematical concepts related to Geometry Transformation.

Identification of mathematical concepts in playing activities, namely in weaving the craftsmen have a strategy by imitating the shape of the woven that has been made or already has a mold to make it easier in the weaving process, during the weaving process there are patterns that can produce woven motifs. The mathematical concepts contained in the activity of determining specific rules and strategies regarding how to weave *Base'k* and *Raga'k* are number patterns and flat shapes. The pattern of numbers found in the mata punai motifs can form arithmetic sequences, this can be seen from the appearance of white rattan blades interspersed with black rattan blades in each row which forms the motif of the punai eye. It was identified that there were eleven rows of white rattan blades that

formed this motif, in the first row one white rattan blade appeared, the second to fourth row increased by one from the previous row, then in the fifth row the number was the same as the fifth row. four, after that the sixth row is increased by one from the fifth row, then in the seventh row it is reduced by one from the sixth row, in the eighth row the number is the same as the seventh row, then the ninth row until the last line, namely the eleventh row is reduced one from the previous row. The following is a figure of the analysis of the number pattern on the Punai eye motif.

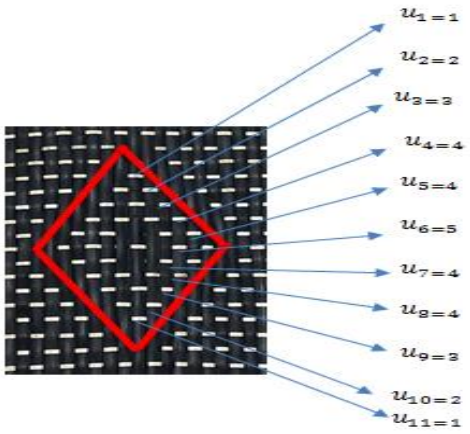

Figure 3. Number Patterns on the Mata Punai Motif

From the figure above it can be written the number pattern 1, 2, 3, 4, 4, 5, 4, 4, 3, 2, 1, the number pattern is a repeating sequence pattern 1 2 3 4 4 and 4 4 3 2 1, if arranged will form the following pattern:

1 2 3 4 4 5

1 2 3 4 4

1 2 3

1 2

1

Then the number pattern of the matting that is formed is 1 2 3 4 4 5 4 4 3 2 1 1 2 3 4 3 2 1 1 2 1, with u_(1=1) , u_(2=2), u_(3=3), etc. From this number pattern, a rhombus flat shape will be formed. Mathematical concepts in this matting can be found in the structure, shape and pattern of the plaiting, so that it can be identified that the mathematical concepts contained in the plaiting strategy are the concept of number patterns and plane shapes.

Product marketing is done by utilizing social media accounts such as Facebook, WhatsApp and Instagram. There were also those who ordered directly by visiting the craftsmen directly, and from Dekranasda also bought these products to be marketed and their existence improved so that buyers from various regions in West Kalimantan and even outside the island also ordered/buyed the products. The mathematical concept contained in the activity of determining the marketing strategy for *Raga'k* and *Raga'k* woven products is Opportunity.

Identification of mathematical concepts in the explanining activity (explaining), namely the maturity level of rattan material that is suitable for weaving *Raga'k* and *Raga'k*, the best is rattan that has a dark green color, while rattan that is still white in color is rattan that has a high level of maturity. still young. The quality of the wicker is influenced by the maturity level of the rattan, the older the rattan used, the better the quality of the wicker produced. This can be identified using a mathematical concept, namely the number line (Bishop, 1988). Based on relevant research conducted by Puspasari et al (2021) entitled Disclosure of Mathematical Aspects in the Ethnomathematical Activities of Ecoprint Production at the El Hijazz Boutique, there is an activity explaining that the motifs produced from the ecoprint technique process show the shape of the motif as it is from flora (because the motif material is materials used are original from nature, for example leaves, flowers and stems). With the arrangement of motifs that are free so that this ecoprint motif does not contain symbolic meaning or special meaning, so it is included in modern motifs. Some designers call this ecoprint motif belonging to the floral textile design.

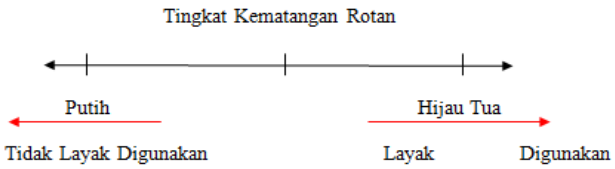

Figure 4. Number line on rattan maturity level

CONCLUSION

The ethnomathematics activities found in the *Raga'k* and *Raga'k* weaving processes are: 1) Counting activities occur when calculating the number of products, the number of weaves, the number of stems, segments, and rattan blades; 2) Measure activity occurs when measuring the length and diameter, width and thickness of the rattan slats, the time required to prepare the rattan material, the area for weaving, the size of the plaits, the price of the product; 3) Locating activities, namely determining where to take rattan materials, placing rattan materials, and placing woven products, 4) Designing activities

occur when determining the basic shape of woven and various woven motifs; 5) The activity of playing occurs when determining the technique of coloring motifs, rules and strategies, and marketing strategies for woven products; 6) Explaning activity (explaining) namely determining the exact time background for taking rattan.

The results of the study show that the mathematical concepts contained in the *Raga'k* and *Raga'k* woven are typical of the Dayak Bidayuh community, Bengkayang Regency, namely; In the counting activity, there is the concept of addition and multiplication operations on integers and the concept of equivalent comparison. In the measure activity, there are the concepts of measurement, area, geometry and linear programming. In the locating activity there are the concepts of probability and set. In the designing activity there is the concept of Geometry Transformation. In playing activities, there is the concept of number patterns. In the explaning activity, there is the concept of a number line.

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