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## GEO METRIC PATTERNS IN THE BACK STRAP WEAVING OF BONTOC, MOUNTAIN PROVINCE

JAY B. NAPANOY-Mountain Province State Polytechnic College Bontoc, Mountain Province

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**ABSTRACT** – *Backstrap weaving is one of the oldest forms of weaving. It involves set of sticks, threads or strings and the hand technique of the weaver. In Bontoc, back strap weaving locally known as sinnawed is still practiced up to this date. However, the stories and the significance behind the patterns and designs in the woven products were not yet known to the new generations. To bridge the gap, this study is conducted to record and document the patterns and designs in the back strap weaving of Bontoc especially those related to mathematical concepts. Moreover, this qualitative study focused on the exploration of the mathematical ideas, concepts and skills involved in the backstrap weaving of Bontoc, Mountain Province. This determined the types of designs and patterns of the back strap that were created. Aside from that, this determined the significance of these patterns and designs found in the back strap weaving in the Bontoc culture and lastly, this study identified the mathematical ideas, concepts and skills are involved in the weaving of the back straps. Results showed that the common designs in the backstrap weaving of Bontoc particularly the original lufid commonly known as pitay are matmata, tiktiko, pagpag, tagtagkho, tufay, kalasag and uweg. These designs produced two Geometric patterns namely P1 and PMM. In addition, these patterns and designs denote the life and practices of the Bontoc people, their environment and their culture as a whole. Furthermore, counting principle, congruency, shapes and figures including symmetry of groups were found in the back strap weaving of Bontoc.*

**KEYWORDS** – back strap, Bontoc, culture, designs, patterns, symmetry, weaving

### INTRODUCTION

Weaving is said to be the outcome of basketry and mat-making. This consists of interlacing the threads of same or different colors. Back strap is one of the oldest forms of weaving. This is practiced by different cultures around the world. It combines the set of sticks, threads or strings and the hand technique of the weaver.

Backstrap weaving or locally known as *sinnawed* is not new in Bontoc. Bontoc is located in the heart of Mountain Province. It is the central business hub and the seat of the provincial government. Bontoc is comprised of 16 barangays with the 4 central barangays considered as the center of commerce, Bontoc Ili, Poblacion, Caluttit and Samoki. Even though Bontoc is the center of commerce in Mountain Province, the native folks including those younger generations



still practice backstrap weaving up to this date. With the influx of commercialization, they still prefer backstrap weaving than the loom weaving. Backstrap weaving is shown on plate 1.



Plate 1

Bontoc people particularly the talented women of Samoki weave for clothing and blankets for the living and the dead using the back strap weaving. These blankets have colorful designs and patterns related to the cultures and traditions of Bontoc. Back strap weaving according to the Samoki weavers was handed down from their ancestors. The techniques and designs were taught to them including the stories behind the designs and patterns in their clothing.

Patterns and designs in the woven materials of Bontoc is the combination of their mathematical ideas intertwined with their experiences. These were seen in their designs of backstrap weaving. According to Baylas, Rapanut and De las Penas (2012), mathematics is embedded in the people's culture particularly in the designs and patterns of the woven clothes.

In Bontoc, Mountain Province, there were few studies on weaving and only two were published. These published studies just included some information about weaving particularly on the culture behind it (Botengan, 2004) and the costumes of Bontoc (Botengan, 2002) but none studied on the meanings and significance of the different symbols, designs and patterns embedded in the Bontoc woven clothes particularly on the mathematical aspects of these designs and patterns. These designs and patterns related to Mathematics are very much needed today because of the mother tongue.

This study is conducted to record and document the patterns and designs in the back strap weaving of Bontoc especially those related to mathematical concepts. This is also a means of preserving the art and stories behind the patterns and designs in the back strap weaving for the next generation to come.

## OBJECTIVES OF THE STUDY

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This study focused on the exploration of the mathematical ideas, concepts and skills involved in the back strap weaving of Bontoc, Mountain Province particularly the Geometric Patterns. Specifically, this study has the following objectives:

1. To determine the types of patterns and designs of the woven back straps are created by the weavers
2. To determine the significance of these patterns and designs found in the backstrap weaving in the Bontoc culture
3. To identify the mathematical ideas, concepts and skills are involved in the weaving of the backstraps

## MATERIALS AND METHOD

This study made use ethnographic design which focused on the exploration of the mathematical ideas, concepts and skills involved in the back strap weaving of Bontoc, Mountain Province. It combines narrative because this covers the stories of the weavers. Documentary descriptive analysis of the woven patterns and designs was employed in this study. Interview with the weavers was used to validate the results.

This study focused on the Samoki and Bontoc Ili weavers with more than 40 years of experience as a weaver. As said by the informants, the original weavers of Bontoc came from Kidlaa (Samoki) and Churyaa (Bontoc Ili). The original *tapis* or locally known as *lufid* will be used in the exploration of mathematical ideas and concepts.

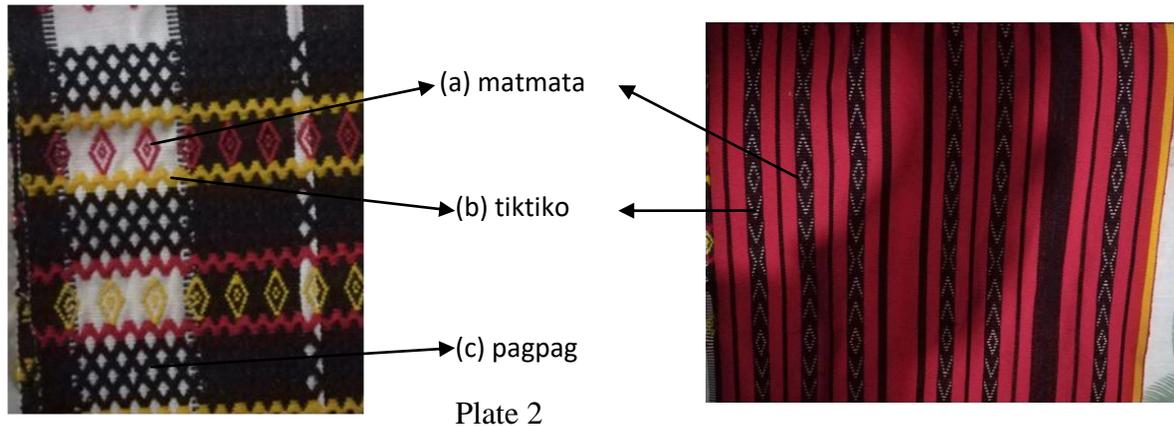
After documenting the woven clothes, the researcher interviewed the weavers. The experienced weavers (Oloan and Fagyan, 2018) explained the patterns and designs of the woven blankets (*pinagpakhan*), wrap around skirt (*lufid* or *pitay*), G-string (*wanes*) and some unfinished clothes. Their responses were also validated by a retired teacher Mrs. Julia Bete, an expert in weaving.

## RESULTS AND DISCUSSION

The Bontoc women weave for decorative blankets for clothing, for ceremonial use and for trade. The combination of the common designs namely, *matmata*, *tiktiko*, *pagpag*, *tagtagkho*, *tufay*, *kalasag* and *uweg* produce the Bontoc patterns which was analysed in this study. These designs are festive expressions of the Bontoc culture and environment. As such, the *matmata* which is the diamond-shaped implies the eye of God seeing His children on earth. The *tiktiko* which is the v or inverted v-shaped or the zigzag designs in the woven products are



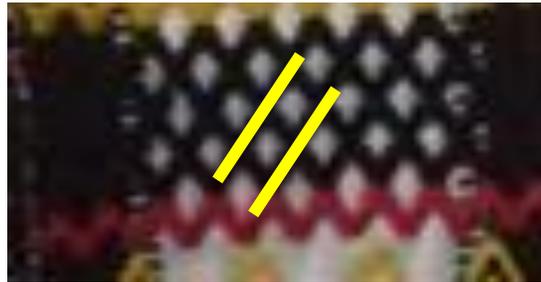
the mountain ranges where the fields of the Bontoc people are located. The *pagpag* refers to the abundance of rice grains and wealth. This is seen in plate 2.



The combination of these aforementioned designs produced the Bontoc pattern in backs trap weaving. In analyzing the patterns found in the Bontoc woven products particularly the original *lufid*, the Washburn and Crowe's flow chart was used as cited in Nelson, A., Newman, H., Shipley, M. (nd) in Plane Symmetry Groups. It can be noted that there are only 17 distinct groups that all the repeating patterns belong. According to Crowe (1988), repeating patterns found in bathroom tiles, quilts, rugs, wallpapers, in architecture, nature, art, in mathematics, etc., these would belong to one of only 17 distinct symmetry groups. These symmetry groups are of two-dimensional repetitive patterns which are classified by what type of rotations, reflections, translations and glide-reflections each pattern has (Nelson, Newman & Shipley, nd).



(a)



(b)



(c)



(d)

Plate 3

Using Washburn and Clowe's flowchart, plate 3 shows that only P1 and PMM are present in the back strap weaving of Bontoc particularly on the *lufid* or commonly known as the *pitay*. P1 is the first group of symmetry made up of only translation. The lattice or the structure is a parallelogram so the translation axes may be inclined at an angle. The picture or the pattern remains unchanged no matter how many translation you apply. This group is the simplest pattern and you can just merely look at it. This is seen in figure 2 (a) and 2 (b).

On the other hand, PMM is the eight group of symmetry. This group contains reflection whose axes are perpendicular. The rotations are half-turns. The lattice is a rectangle. This is seen in figures 2 (c) and 2 (d).

### Significance of the patterns and designs in the Bontoc culture

The patterns and designs including the colors found in the woven clothes of Bontoc signify the culture, environment and the people of Bontoc as a whole. As mentioned by Bete (2018), the *pinagpakhan* has five panels. One panel called the *pakhawa* represents the Chico River between Samoki (Kidlaa) and Bontoc Ili (Churya-a). Two panels called the *paikhid* represent the two *baran gays* or brothers as they say in Bontoc, Kidlaa and Churya-a facing each

other. Two panels at both ends are the *langkit* representing the boundaries of Bontoc. This is seen in plate 4



Plate 4

The *paikhid* is dominantly red and black stripes in color. The black and white stripes were grouped according to the length of wake of the dead as determined by his or her social classification. The five stripes towards the *pakhawa* signify the five-day wake of the leader or commonly known as the *papangullo* of the clan. The three-stripes at the middle represent the three-day wake of the *kakachangyan*. The one-stripe design at the edge represents the one day wake of the *pupusi*. All in all, the designed stripes are nine which is seen also in the G-string called the *fanchala* and the *lufid* of the *papangullo* when they die.

Moreover, the designs *matmata*, *tagtakho*, *talaw*, *kalasag*, *tufay*, *u-uweg* and *fatfatawil* found in the two panels of the *paikhid* signify the traditions of Bontoc. The *matmata* is the diamond-shaped figure represents the eye of *Kabunyan* watching the people of Bontoc. The *tagtakho* is the man-like figure which represents the people of Bontoc. The *talaw* is the star-like figure representing the stars which guides the people of Bontoc for hunting, war and agricultural purposes. The *kalasag* and *tufay* are the shield and spear that represent the tools used by mean during hunting or *faluknit*. The *u-uweg* is the snake-like figure that represents the good and bad signs in going to war. The *fatfatawil* is the x-like design representing the two rods used by mean of Bontoc to carry the two sons of Lumawig killed at Can-eo, one of the barangays of the municipality of Bontoc.

The *pakhawa* on the other hand have designs *matmata*, *tik-tiko* and *pagpag*. The *matmata* represents the social classification of the wearer. The *tiktiko* is the set of zigzag figures represents the mountain ranges of Bontoc. Lastly, the *pagpag* is the black design between the *tiktiko* that represents agricultural matters. The plain white without design or commonly known as *lanlan* represents the Chico River.



### **Mathematical ideas, concepts and skills found in the backstrap weaving of Bontoc**

Backstrap weaving of Bontoc is full of mathematical ideas and concepts. Mathematical skills are also seen in their weaving. It all starts in the counting principle because as Oloan (2017) said, “*importante nan filang nu in-afe ta...* (counting is important in backstrap weaving...)”. Counting is definitely the basic skill the weavers need to master. Another is the concept of parallelism. As seen in the figures, the stripe designs are parallel with each other. Even the color combinations of the stripes are somewhat parallel. Aside from that, ideas in Geometry such as diamond-shaped, v or inverted v-shaped, parallel stripes, congruency of figures and similar shapes are seen in the woven clothes of the Bontoc people. This is seen in the designs *matmata*, *tiktiko*, *tufay* and *kalasag*. Symmetry of groups particularly on translation and reflection are also present.

### **CONCLUSIONS AND RECOMMENDATIONS**

Based from the findings of the study, the woven clothes particularly *pinagpakhan* of Bontoc follow a geometric pattern similar to other woven clothes of Africa and Asia but with different variations on the designs, styles and their meanings. Comparing it with other patterns, the Bontoc woven clothes are simpler with fewer patterns to follow. Next, patterns and designs in the woven clothes of Bontoc have significant and festive meanings in their culture. These cover their lives, their surroundings, their class status as *kachangyan*, *pupusi* and *lawa*, their agricultural harvest and *Kabunyan*, the Almighty God. Lastly, mathematics is always inculcated in every walks of life including backstrap weaving of Bontoc. The concepts, skills and ideas of Mathematics in the backstrap weaving is very much needed today for the children to know and understand the application of Mathematics in weaving.

In light of the findings and the conclusions drawn, the following are recommended: (a) the geometric patterns of the other woven materials such as the g-string should be studied if there are similarities with the *pinagpakhan*. Stories behind every pattern and designs are also interesting to look into; (b) the variations of the designs from the first woven clothes should be studied to showcase the changes of perspectives of the weavers from the olden times to present; and (c) document the mathematical concepts, ideas and skills in the woven clothes for the incorporation of Indigenous Peoples Education in Mathematics.

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