



MATHEMATICS OF FOLK ART: THE GEOMETRIC MOTIFS IN THE EMBROIDERIES OF IKALINGA

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Abstract: *The paper was primarily conceived to identify the different kinds of embroideries of the Ikalings, figure out the basic geometrical motifs and the significant implication of these identifiable motifs to the lives of the Ikalings. It employed the descriptive ethnographic approach, unstructured interview and documentary analysis of existing embroideries of the Ikalings. The findings revealed that, Kalinga embroideries are wrought with symbolism; geometric motifs are usually related to culturally significant domains and are expressed in different designs of a weaving. Many concepts are illustrated through metaphors used within an embroideries context; shapes in the woven designs are related to elements of everyday life, ceremonies, nature or cosmology. Even simple design is latent with motifs whose origin is found in the earth, sky and nature. The symbolism found in every art is extraordinarily rich in heritage and culture which provide the weavers with connection to their ancestors and traditions.*

Keywords: *Mathematics, Folk Art, Geometric Motifs, Embroideries*

INTRODUCTION

Globalization has brought about demographic changes and a plurality of cultures in various countries. The different aspects relating to multi-cultural society are becoming increasingly significant to education in general and mathematics education in particular. Discussing the faces of mathematics from this point of view has the potential of understanding mathematics as an area whose face is diverse and can be interpreted in both formal and local aspects. The first interpretation as recognized in its formal definition, which can be conceptualized by the mathematician and is sufficiently absolute, perceptually speaking, is to be understood by learners thousands of miles apart – one, perhaps, in Kalinga. The second interpretation stems from expanding the world of the mathematical concepts by local aspects that are influenced by various explanations – culture, era and human history.

This realization requires us to hold a purposeful discussion about the added values in mathematics education. It is possible that “Mathematics of Folk Art”, which is an expression of a Multicultural View of Mathematics, helps us understand the role of mathematics in a



multi-cultural society. The meaning of the term, Mathematics of Folk Art, expressed by its socio-cultural aspect, includes within it the language, verbal lexicon, behavioral norms and symbols of a certain group, and in its mathematical aspect it includes such actions as "the corpus of knowledge derived from quantitative and qualitative practices, such as counting, weighing and measuring, sorting and classifying, sequencing, exemplification, formation, and reconstruction. Regarding the actions that are identified with the mathematical aspect, there are a wide variety of existing implementations, enabling explanation of the processes that characterize practical mathematics in traditional work.

In Kalinga, weavings are wrought with symbolism. Geometric motifs are usually related to culturally significant domains and are expressed in different designs of a weaving. Many concepts are illustrated through metaphors used within a weaving context. Many of the individually woven designs are related to elements of everyday life, ceremonies, nature or cosmology. Even simple geometric designs are latent with motifs whose origin is found in the earth, sky and nature. The symbolism found in the weavings is extraordinarily rich in heritage and culture which provide the weavers with a connection to their ancestors and traditions. Specifically in Barangay Mabilong, Backstrap weaving art handed down as heirlooms bearing different designs and figures mostly representing mythological interpretations which are symmetrical and well-finished" as a means of awareness, appreciation, and preservation of the traditional art of hand woven for the next generations to come.

The researcher as one of the educators of the Mathematics Prospective Teacher of our institution encountered culturally embedded mathematics which created a learning environment that encouraged her and nurtured interdisciplinary contexts and personal connections with one another and to the lives outside the classroom walls. This approach cultivated an acceptance that academic mathematics is only one side of the mathematics coin, the flip side being the one on which mathematics shows itself as a humanistic and socially embedded discipline. This development suggests that responsibility on the shoulders of professional mathematics educators lies in caring for creation of a learning atmosphere where the two facets of mathematics shall walk side by side. Incorporating Ethno mathematics into mathematics teacher education would seem to advance this goal, given the personal respect and appreciation for one another and their respective heritages



that developed across the cultural boundary between the two often highly contentious groups of which the MPT are members. We, the Mathematics educators, should lead the Mathematics Prospective Teachers' experiences so that they are likely to link classroom encounters with mathematics content and pedagogy, as well as ethno mathematical activities, that have definite affective and cognitive meaning for the learners in their national, ethnic, or family cultural realms.

CONCEPTUAL FRAMEWORK

Geometric shapes are what most people think of as shapes, squares, triangles, diamonds which are made up of regular patterns that are easily recognizable. This regularity suggests organization and efficiency. It suggests structure. Geometric shapes tend to be symmetrical that further suggest order there are truly an endless variety of shapes and combination of shapes, each in which communicate its own meaning and message. Often the meaning behind shapes is cultural, particularly as shapes are combined. Shapes are two-dimensional areas with a recognizable boundary. They can be opened or closed, angular or round, big or small. Shapes can be organic or inorganic. They can be free-form or geometric and ordered. Shapes can be defined by their colors or by the combination of lines that make up their edges. Simple shapes can be combined to form complex shapes. Complex shapes can be abstracted to make simple shapes. The different characteristics of a shape convey different moods and cultural meanings. Changing the characteristics of a shape alters how we perceive that shape and make us feel differently about a design. Shapes are powerful way to communicate traditions and cultures.

The reference is to the accumulated store of mathematical knowledge that over time becomes" the oral law that is passed from father to son and from mother to daughter" (Katsap, 2004). For instance, a Kalinga woman observing her rituals will instruct her daughters how to embroider, and put into practice compositions requiring basic comprehensive knowledge in the field of Geometry, such as squares, triangles, and symmetry. However, often the people involved in math education have been unaware of the actual fact that "mathematical procedures, patterns, and structures are developed by human beings, living and working in societies," or ignoring them altogether (Shirley, 2006).

To the Ikalanga, to maintain and develop intangible cultural heritage, Peralta (2005) posits that a person's legal status must be clearly defined through legislative action, a relevant law



right of attribution, and an organization. Weaving products with associated geometrical figures have real as well as symbolic value. Traditional weavers associated special meanings with weaving designs. These designs tended to have specific meanings for particular practices and beliefs that the Illubuagan have.

In Mountain Province ethnic woven products are ethnic blankets and ethnic clothes for both males and females. The common motif used for the ethnic woven textiles are the eye design (*mata*), X- design (*sinikwit/sakaw*), human figure, snake, flower, star, V- shaped design (*suksukyong*), zigzag, lattice design of diamonds, spear(*gayang*), shield (*kalasag*) and lizard. Patterns of weaving are generally striped with or without designs which are dependent on the economic status of the wearer. The most prominent color is bright red with specks of black, white, yellow or green colors. The designs, patterns, symbols and colors of the ethnic hand woven products generally stand for the social standing and economic status as well as for gender distinction. Brightly colored garments are for the upper class and dimly colored/white colored garments are for the lower class. The color combinations also imply whether the garment is for the living or for the dead. The presence of green and yellow indicates that the woven garment is for the living and the absence of the mentioned color means it is for the dead. Similarly, the design also indicates the economic status of an individual. The more intricate the design, the richer the individual is, wearing that certain garment. The simpler it is, the lower the class of the wearer.

In like manner in order to preserve this traditional products, among the Igorots in Mountain Province, the move of the officials in Mountain Province is to use their woven products in the uniforms of government employees and their Lang-ay Festival, which heavily utilizes woven products are just examples by which they could educate the youth to preserve their culture. The use of technology in any aspect of our lives is important but, we should not forget the real essence of what we are doing even if technology already changed our way of doing it.

Mandaya are famous for their distinctive costumes and ornamentation, which involves tie-dyed textiles and embroidery using a sophisticated system of symbols and geometrical figures with named motifs. Geometrical patterns are often enclosed in rectangles and arrange in border designs while the Mansaka tribe is also fond of making dagmay or abaca cloth. Making a dagmay using traditional method is said to be extraordinary and tiring.



Among the geometrical figures in the designs of dagmay include squares, human forms, laron na opat (crocodiles) and dots.

The cultural beliefs and practices of the Bagobos are reflected in some of the designs on their woven cloth. Their unique created design resembling the dancing man motif with a blanket on each arm, may suggest a rain making ritual. Some of the figures form the frog and lizard, which are symbols of fertility among the pagan groups while the Bagobos often use straight line motifs, their symbolic designs are occasionally take the form of the sun, stars, lightning and the dancing man.

Abra weaving namely pinilian, binakol, and kiniri are typical weaving techniques of the Ilocos region until the region was divided into separate provinces of Ilocos Norte, Ilocos Sur and Abra. "The figures *pinilian* is usually a blanket design that depicts fruits such as pineapple and guava as well as men riding a horse, calesa or banca. As you can see, these fruits are one of the main produce in Abra while the calesa and banca show their transportation in the area and their main livelihood, which is fishing. Usually, it only has two colors, the dominant color of green, rustic orange or blue and white for the designs," As for the binakol, these are recognized for its uniform geometric motif often resulting in dizzying optical art designs made to represent the waves of the sea.

CULTURAL RESEARCH OBJECTIVES

This study looked into the Geometric Motifs in the Handwoven Embroideries of the IKalinga; specifically, it sought answers to the following objectives:

1. Identify the basic geometrical figures in the Kalinga embroideries;
2. Find out the significant implication of these identifiable geometrical motifs to the lives of the Kalinga and to teaching and learning; and
3. Classify the use of the different ethnic hand woven embroideries of the IKalinga.

METHODOLOGY

The paper made use of ocular observation, unstructured interviews; descriptive ethnographic approach and documentary analysis of existing embroideries products of Kalinga, documentation of existing studies and experiences plus knowledge and feedbacks from the researcher immersion in the locale of the study to substantiate data to be gathered from the respondents. The respondents of the study were traditional weavers









based in Lubuagan, to be included in the poll of respondents as well as those sellers of traditional weavings based in Tabuk.

SIGNIFICANCE OF THE STUDY


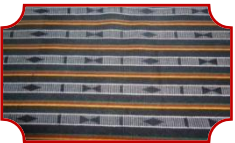
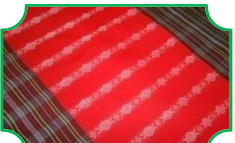

The preservation of culture needs documentation of existing ethnic cultural practices in everyday living. This is the challenge and opportunity decipher in the IPED (Indigenous People Education) The findings will also serve as a background or a framework for school administrators and teachers for the documentation to be included to the curriculum or subject TLE(Technology and Home Economics) to promote the Kalinga weaving from one generation to another generation.

RESULTS AND DISCUSSION

Geometric Motifs of the Hand Woven Embroideries and Its Implication to the Lives of the Ikalunga

 	Name	SILUGWID
	Geometrical Figures	Connected Triangles (Zig-zag) , horizontal lines
	Cultural Implication	It portrays the home of the Ikalunga tribe, it represents the mountainous landscape of the place that composed of trees and plants, the mountains where the Ikalunga sow their palay and perform their rituals and ceremonies. The horizontal line segments signify rice terraces which leave a sense of self-possession among the Ikalunga.
 	Name	SILAMBITOWON
	Geometrical Figures	Star, Diamond, horizontal and vertical lines
	Cultural Implication	The star and the diamond are insects patterns which depicts fertility symbols, Vertical lines symbolizes sunrise cast upon the place
 	Name	LILUWALUWANG
	Geometrical Figures	Carabao figure, Horizontal and vertical lines
	Cultural Implication	It signifies wealth and support. It represents support because it is being utilized by the Ikalunga in working the field as source of livelihood.



	Name	KILULUKULUP
	Geometrical Figures	Kuup (owl) figure, Diamond, horizontal lines
	Cultural Implication	To the Ikalanga, the symbolic meaning of owl revolved around guardianship of the underworlds, and a protection of the dead. In this light the owl is ruler of the night and seer of souls. It should be cleared that the owl is honored as the keeper of spirits who had passed from one plane to another.
	Name	LILUSULUSSUNG
	Geometrical Figures	Connected triangles on its vertex, diamond, and horizontal lines
	Cultural Implication	The two connected triangles on its vertex represent the lusung, the material culture of the Ikalanga use to pound palay to be served to the family.
	Name	KILAWAKAWA
	Geometrical Figures	Kawa figure (spider) and vertical lines
	Cultural Implication	It signifies patience and possessiveness and it is attributed to the Kalinga culture with the origination of weaving, spinning and net making. The spider is a symbol that awakens creative sensibilities. It weaves a web of subtle fabric, as if to remind us that the past always subtly influences the present and future.
	Name	SILLAKASAKAW
	Geometrical Figures	Connected diamonds, horizontal lines
	Cultural Implication	It symbolizes a woven rattan attached to a wall where kitchen wares like panay plates and bowl.
	Name	K A Y A W
	Geometrical Figures	A Woman figure, spear, and vertical lines, horizontal lines
	Cultural Implication	The <i>kayaw design</i> has a motif of a shield and a woman carrying pot. Kalinga women are using pots to cook their foods and as a container to store water while the shield and the arrow as seen in the design pattern were tools being used by the early Ikalingas to fight in a battle and used the tubay to hunt laman (wild pig) for their food.



Other Woven Embroideries which Possess Similar Geometric Motif and Implication to the Lives of The Ikalanga

DESIGN	NAME OF DESIGN	GEOMETRICAL FIGURES	DESIGN	NAME OF DESIGN	GEOMETRICAL FIGURES
	<i>Ilaglis and Billulilaw</i>	Zig-zag, and horizontal lines		<i>Ilaglis</i>	Horizontal lines, and Zigzag lines,
	<i>Biliumbulilaw</i>	vertical lines		<i>Silambituwon</i>	Diamond, and star figure
	<i>Ilaglis</i>	Zig-zag, and horizontal lines		<i>Gilinging</i>	Horizontal lines
	<i>Binaliktad</i>	Rectangle, diamond, and vertical lines		<i>Pilaslang</i>	Horizontal lines
	<i>Chilayuschus</i>	Vertical lines		<i>Chilayuschus</i>	Horizontal lines, and Zigzag lines
	<i>Lilabey Design</i>	Vertical lines		<i>Bilallikted</i>	Vertical line, square diamond
	<i>Sampaguita</i>	Horizontal, and diamond		<i>Lilabey</i>	A period and Horizontal lines)
	<i>Sillayyuti (Horizontal, diamond, star)</i>	(Horizontal, diamond, star)		<i>Lilaglob</i>	Horizontal lines period, and cross)
	<i>Sillakasakaw W/ Silambituwon</i>	Horizontal, diamond, and star figure		<i>Lilingalingaw</i>	Horizontal lines, and diamond
	<i>Silambituwon W/ Gamat</i>	Horizontal, diamond, star, and a point		<i>Chilayuschus</i>	Vertical lines, square, diamond, and star



The different geometric motifs in the Ikalunga embroideries have great role in the lives of its people; they invoke the feelings of its people based on its cultural background and are designed for special purpose. Many concepts are illustrated through metaphors used within a weaving context. The connected triangle or the horizontal zigzag pattern, and the line segment connected to it seen in many ethnic hand woven products offer more lively sensations, for it portrays the home of the Ikalunga tribe, it represents the mountainous landscape of the place that composed of trees and plants, the mountains where the Ikalunga grow their palay and legumes and perform their rituals and ceremonies. The horizontal line segments signify rice terraces, leave a sense of self-possession among the Ikalunga. Terrace farming is being practiced of the slope of a mountain; fields are cut and filled so they resemble steps. These terraces prevent erosion from the area; Vertical lines symbolize sunrise cast upon the place suggest a new life, feeling of stability, that gives everyone a hope; the stars and insects patterns depict fertility symbols. Moreover, the star also seen in the Kalinga embroideries also reflects light that brightens the path and guides the people before who were traveling on carabaos from neighboring places and also during noontime when elders were going to pound their palay(*pagoy*) while children enjoy playing as pointed out by *Silamay Dongga-as*;The two connected triangles on its vertex signify the *lusung*, the material culture of the Ikalunga use to pound their food to be served to the family.

The *kayaw* design has a motif of shield and a woman carrying pots indicate that Kalinga women are using pots to cook their food, as water container, as a *ful'nay (container for basi)* or as kitchen utensils while the spear shield (*tu'vay and say-ang*) as seen in the design pattern are tools used by the early Ikalungas to fight in battle(tribal wars) and the spear was also used to hunt wild animals (*laman*).

The crisscross or intersections of the horizontal and vertical lines, or connected diamonds in the *sakaw design* symbolize a woven rattan attached to walls, where kitchen wares like Chinese plates (*panay*), common plates, and bowl are kept clean and dry. The *kinulkulup design* has a motif of an owl (*ku'up*), the name was derived from a name of a big bird called *ku'up*. In the Kalinga culture, the symbolic meaning of an owl revolved around guardianship of the underworlds, and a protection from the dead. In this light, the owl was a ruler of the night and seer of the souls. A misunderstanding of this necessary relationship gave the owl some negative associations with death. It should be cleared that the owl was honored as the



keeper of spirits who had passed from one plane to another. Often, myth indicates the owl accompanying a spirit to the underworld - winging its newly freed soul from the physical world into the realm of spirit. The *Kilawakawa design* has a figure of spider (Kawa) which symbolizes patience it signifies possessiveness and it is attributed to the Kalinga culture with the origination of weaving, spinning and net making. The spider (*kawa*) is a symbol that awakens creative sensibilities. It weaves a web of subtle fabric, as if to remind us that the past always subtly influences the present and future. Often the webs will take a spiral shape, the traditional form of creativity and development. The spider (*kawa*) found within the web reminds us that we are the center of our own world. The *Liluwaluwang design* with a motif featuring a carabao, signifies wealth and support. It represents support because it is being utilized by the Ikalunga in working in the field as a source of livelihood.

As a whole, many of individually hand woven embroideries are related to elements of everyday life, ceremonies, nature or cosmology. Even simple geometric designs are latent with intricate geometric motifs whose origin is found in the earth, sky and nature. The symbolism found in Ikalunga Embroideries is extraordinarily rich in heritage and culture which provides the weavers with a connection to their ancestors and traditions.

Classification of the use of the handwoven Embroideries of the IKalinga

Kalinga, where you can find the women with skillful hands and whose ingenious pieces reflect Kalinga's culture. Back strap weaving is the skill of 90% of women Lubuagan, Kalinga and the loom woven products from this tradition became a One Town, One Product (OTOP) of the municipality.

1. Housewares (blanket, bed cover, seat cover, pillow cases, flower vase accent, curtains)





2. Linen(Placemats, runner, Table cover)



1. Men/Ladies wear (Blouses, dresses, shawls, Gowns, Blazers, Men and ladies barong, coats, jackets, ponchos, chaleco, t-shirt accent)



Blouses' Accent

Dress

Blouse and Skirt

Gowns



Men and Ladies Barong Jacket

Ponchos

Chaleco

T-shirts' Accent

2. Accent to Church Vestments accessories (Dalmatic, causable, Cossack, lectern, and etc)



Dalmatic

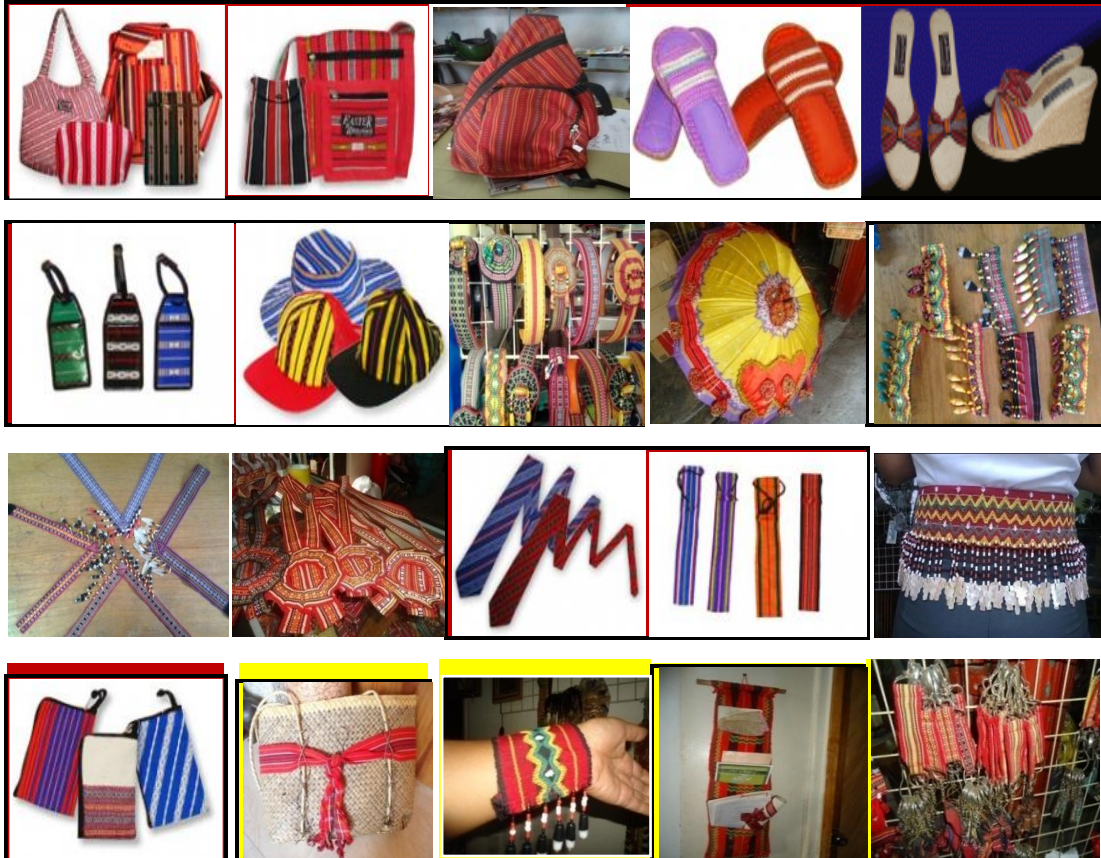
Chausables

Priest stoles

Burse and Veil

Frontal

3. Apparels (bags(laptop bag, sling bag, travelling bag, belt bag, shoulder bag, bag pack), wallets, coin purse, neckties, necklace, head wear(head band, ribbon, ponytail, hair clip), footwear (sandals, slippers, boot's accent, and shoes), luggage tag, wrist band, friendship band, book marks, lei, key chain, belt, umbrella accent and etc)



4. Decorative Arts (Frames, School, and community related activities' stage decorations, wall decoration)



5. Fabrics Use during Cultural Presentation.



CONCLUSION

1. Kalinga embroideries are wrought with symbolism; geometric motifs are usually related to culturally significant domains and are expressed in different designs of a weaving. Many concepts are illustrated through metaphors used within an embroideries context; shapes in the woven designs are related to elements of



everyday life, ceremonies, nature or cosmology. Even simple design is latent with motifs whose origin is found in the earth, sky and nature. The symbolism found in every art is extraordinarily rich in heritage and culture which provide the weavers' connection to their ancestors and traditions.

2. The woven embroideries of Ikalanga are used as House wares, Table Linen, Men/Ladies wear, Apparels, Church Vestments accessories, Anniversary token, Decorations, and Fabrics.

RECOMMENDATION

In the light of the salient findings and the conclusions, the following recommendations are offered:

1. Mathematics educators should provide opportunities to their students to examine the cultural contexts of mathematics concepts, to further their understanding regarding the multicultural mathematics education, and to explore the presence of naturally occurring mathematics in their ethnic, and family activities and heritage
2. In teaching and learning mathematics concepts on Basic Geometry, the utilization of the findings of the study point towards:
 - a) Improvement in teaching techniques;
 - b) Enriching the program of Mathematics Prospective Teachers;
 - c) Creation of classroom environment conducive to integrating ethno mathematical and multicultural features with mathematics content and pedagogy, and improvement of learning and teaching skills, boosting their interest as learners of mathematics, and deepening their own mathematical content knowledge.

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