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Ethnomathematics in Anatolia-I (in Turkey): Geometry perception in multiculturalism

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Ethnomathematics pursues the goal of viewing mathematics from a multicultural perspective by enlarging its historical background. Culture and mathematical thoughts are in contact and they, together, form an indivisible whole. Therefore, ethnomathematics not only helps us understanding the nature of mathematics but also contributes to understanding of one's self as well as the other people sharing the same planet. Ethnomathematics reflects mathematical thoughts of the studies of multicultural or traditional societies. Mathematical thought is an approach in which people try to find quick and systematic solutions to a problem in diverse ways. In a historical-cultural context, the role of ethnomathematics, which studies mathematical thoughts, cannot be ignored. This paper examines some reflections of geometry perception in carpet and rug motifs in terms of Ethnomathematics in Anatolian culture.

Key words: Ethnomathematics, history of mathematics, anthropology, multicultural education, geometry.

INTRODUCTION

Parallel to the increase in our experiences, new problems arise inevitably leading to the emergence and development of sciences. Today, the quality, causality and the formality of scientific knowledge and science are major research areas. One of the definitions of scientific knowledge is that it is a justifiable knowledge. Moreover, science might be defined as an activity, in which scientific knowledge is gathered systematically (or in paradigms), new questions arise, and those questions are answered by giving way to the emergence of new information in a unique methodological way. Regardless of the definitions, scientific knowledge is a product of human and it is verified and accepted considering the findings of the era it is produced. Thus, scientific knowledge, also, can change or can be reformulated more precisely (Bora, 2005). Ethnomathematics pursues the goal of viewing mathematics from a multicultural perspective by enlarging its historical background. It studies and presents mathematical thoughts of multicultural or traditional societies (Ascher, 1991; Achor, 2009). Multicultural education tries to provide equal educational opportunities for students from diverse races, ethnicities and social groups D'Ambrosio (2001). In line with these, it tries to change and restructure the school environment (Banks et al., 2001). Many educators agree that multicultural education affects teaching process, administration, guidance, program development, performance evaluation and school atmosphere (Gay, 1994). The term Ethnomathematics was first used in late 1960s by a Brazilian mathematician Ubiratan D'Ambrosio. He questioned an unquestioned acceptance up to that time as "What is perceived as mathematics today is definitely a science which is globally used and unique to Western Civilization. The only way to find civilization on earth is to regain the lost respect of losers as well as the joint movement of both winners and losers for a new mathematics. Thus,

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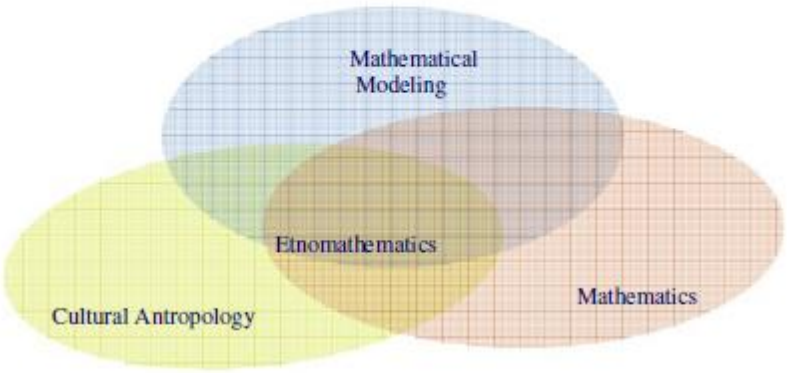

Figure 1. Major disciplines.

ethnomathematics is a step for peace". This questioning made it possible for ethnomathematics-which make use of data and findings of different disciplines like linguistics, sociology, history, philosophy, arts as well as mathematics and ethnology (Figure 1) become one of the major disciplines in time with the help of intense and qualified studies (Bora, 2005).

We can comment that science is not independent from that society's culture. Therefore ethnomathematics might be interpreted as the expressions of mathematical thought in that culture.

Mathematical thoughts include numbers, logic, spatial grouping especially systematic grouping or classification of these items. As a whole, mathematical thoughts are rich and many-sided. There is no one unique development line for every culture. Those cultures cannot be ordered in one line or compared to each other (Ascher, 1991). Students may need to use a mathematical thought so as to interpret other mathematical thoughts; and they may need to consult to mathematical thinking and modeling to solve problems arouse in other disciplines. Moreover, multicultural societies should regard the role of mathematics and contributions of different cultures to the development of mathematics (Strutchens, 1995).

From another perspective, designing an ethnomathematical curriculum for classrooms should not be neglected. The point here is that students not only can realize how their societies do mathematics in their cultures but also notice mathematical thoughts. Besides, they can use this awareness to learn formal mathematics and this awareness facilitates their development of mathematics capability in any situation in the future (Duarte, 2004; Rios, 2000; Rosa and Orey, 2006).

When scientific knowledge was taken in terms of ethnomathematics, it might not be global all the time. It might be local as well. Global knowledge and local knowledge are not contrary things; they complement each other (Bora, 2005). There are a lot of examples in the history of science. For instance;

1. The analysis of numeration systems development is one of the most interesting topics of mathematics history. Today, we use base 10 numeration systems. The justification of this is we have ten fingers.
2. In fact some American or Oceanian local tribes use base 4, 5, 6, 8 or 20 numeration systems with the similar reasons. 4 stands for the number of used fingers except from thumb; 5, the number of fingers in a hand; 6, two times counting of thumb; 8, the number of fingers in two hands except from thumbs; and 20, total number of fingers in hands and feet.
3. The methods used by Oceania inhabitants and Eskimos in sea or in endless glaciers to find their ways show the local feature of mathematics which can be adapted to globalism (Bora, 2005).

FINDINGS

Geometric figures in Anatolian motifs

Carpet and rug weaving plays a vital role in the lives of Anatolian people. People generally weave their carpets on their weaving looms made by themselves. These carpets and rugs do not have only decorative value but also have an indispensable value in village life since they are works of art at the same time. They reflect hopes, moods, missings, sorrow, beliefs, in short, all lives of those people. A unique culture and life is hidden in these carpets. Observing these carpets and rugs is a way of comprehending village life and culture in a sense. Yet, although motifs and geometrical figures in these works of art have deep meanings many of us do not even think of these realities.

This paper seems valuable in terms of examining Ethnomathematics through some reflections of geometry perception in carpet and rug motifs in Anatolian culture.

Some geometrical shapes used in carpet and rug motifs weaved in Anatolia

Figure 2 show samples of some geometrical shapes used

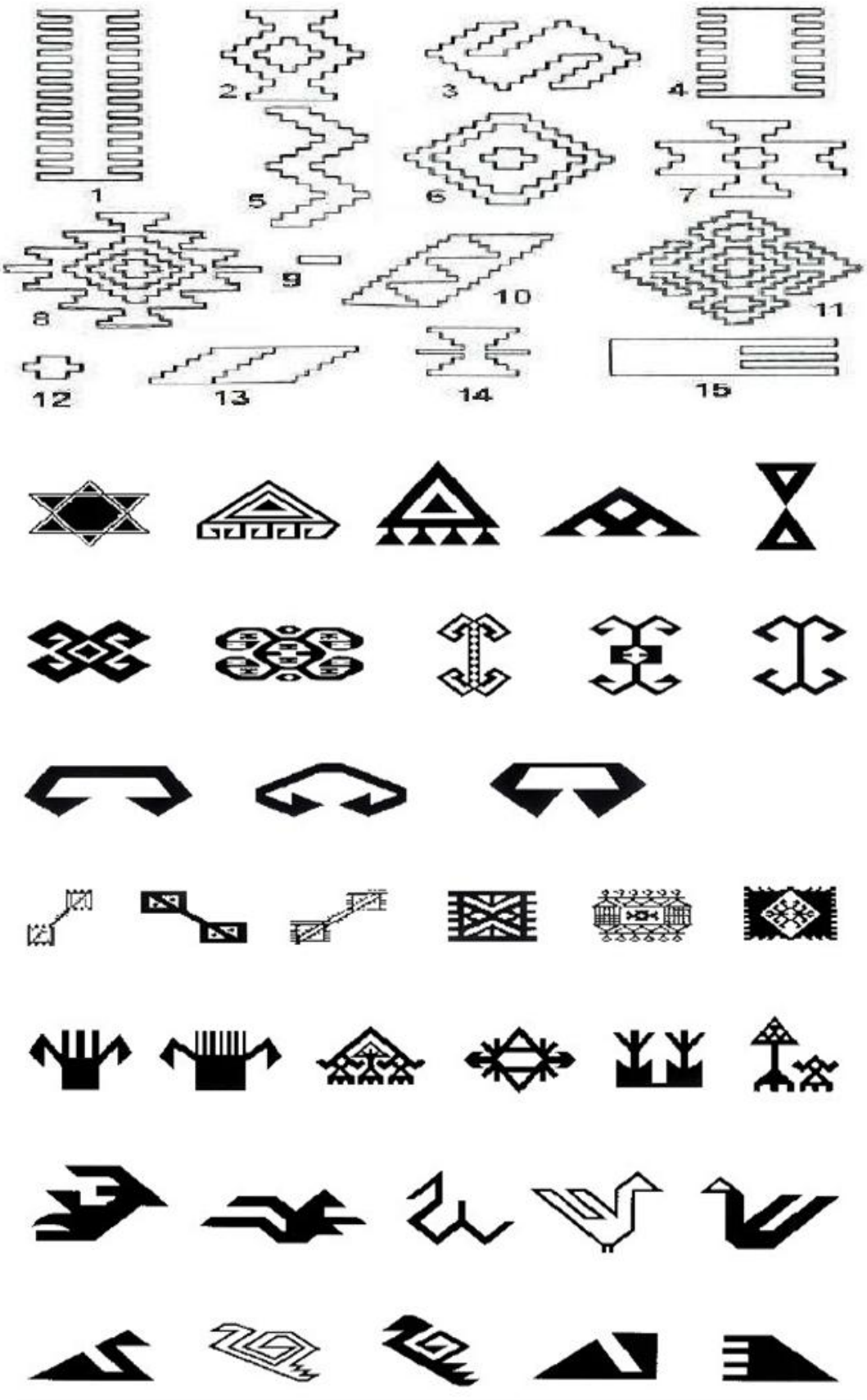

Figure 2. Some geometrical shapes used in Carpet and Rug Motifs Weaved in Anatolia.

Figure 3. Geometrical shapes used in Amulets and evil eye beads.

Figure 4. The Geometrical Shapes used in Bird Figures.

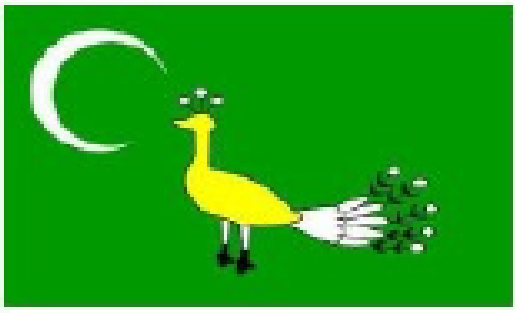

Figure 5. The Flag of Ghaznavids

Figure 6. The geometrical shapes used in Cocklebur figures.

in carpet and rug motifs weaved in Anatolia.

Geometrical shapes used in amulets and evil eye beads

Figure 3 shows geometrical shapes used in amulets and evil eye beads. Generally, it is triangular, quadrangle and pentagon in shape, symbolizes that some people's looks have a kind of power and these looks may lead to misdeed, harm, unluckiness and even death.

Geometrical shapes used in Bird figures

Bird motifs obtained with shapes like triangles, quadrangle and parallel edges in carpets and rugs have many diverse meanings. For instance while birds like owl and raven mean bad luck, dove, pigeon and nightingale are used to symbolize good luck. Bird is the symbol of happiness, joy and love. It symbolizes strength and power. It is also the symbol of many civilizations settled in Anatolia, and empire. For example bird symbol can be seen in the flag of Ghaznavids (961-1187) (Figure 4).

Geometrical shapes used in Cocklebur figures

Cocklebur is a cotton-like plant which sticks to clothes of people and feathers of animals. This motif which is composed of geometrical shapes like equilateral quadrangle and spirals are used to symbolize evil eye and plentifulness (Figure 5).

Geometrical shapes used in chest figures

These motifs which are composed of geometrical shapes like parallel lines, triangles and quadrangles generally symbolize the wedding chest of a young lady. Figure 6 reflects the hopes and expectations of the young lady.

Geometrical shapes used in hook and Latin cross figures

These motifs which are composed of geometrical shapes like triangle, parallel edge, pentagon, hexagon, circle and star are believed to protect people from danger (Figure 7).

Figure 7. The geometrical shapes used in Chest figures.

Figure 8. The geometrical shapes used in Hook and Latin Cross figures

Figure 9. The geometrical shapes used in Eagle figures

Geometrical shapes used in Eagle figures

Eagle figure which includes different geometrical shapes like quadrangle, pentagon, hexagon and 20- gon (20-sides) symbolizes power, strength, amulet, dominance of government and items like spells used in old religious ceremonies (Figure 8).

Figure 10. The geometrical shapes used in Earring figure.

Figure 11. The geometrical shapes used in Cleat figures.

Geometrical shapes used in earring figure

A young lady signals that she wants to get married by weaving this figure using triangle and hyperbole curve (Figure 9).

Geometrical shapes used in Cleat figures

The figure of cleat which is weaved by using trapezoid, triangle, parallel edges and dodecagon represents productivity, heroism, strength and happiness (Figure 10).

Geometrical shapes used in waterway figures

The figure of waterway, which is composed of parallel edges, hexagon and line segments, signifies the role of water in human life (Figure 11).

Geometrical shapes used in star figures

The figure of star which is weaved by using trapezoid,

Figure 12. The geometrical shapes used in Waterway figures.

Figure 13. The geometrical shapes used in Star figures.

Figure 14. The geometrical shapes used in Tree of Life figures.

triangle and parallel edges symbolizes the productivity in that society (Figure 12).

Geometrical shapes used in tree of life figures

This figure which uses line segments, quadrangle and triangles is the symbol of eternity (Figure 13).

Figure 15. The geometrical shapes used in figures like Wolf traces

Figure 16. The geometrical shapes used in Dragon figures

Geometrical shapes used in figures like Wolf traces

In prehistoric times, people used to believe that imitating and drawing or weaving figures of dangerous animals is a good way of protecting themselves from these animals. Thus, figures like wolf traces obtained from trapezoid, triangle, quadrangle and 16- gon were used for the protection from wolves (Figure 14).

Geometrical shapes used in Dragon figures

Dragon is the master of air and water. The pattern obtained by using geometric figures such as triangles, quadrangles, hexagons and line segments on carpets is believed to bring prolific spring rains, to be the protector of mystic objects as treasures and tree of life (Figure 15).

Geometrical shapes used in fertility figures

The figure which consists of equilateral quadrangles, triangles, hexagons and trapezoids symbolizes a family (Figure 16). This pattern is believed to protect the family

Figure 16. The geometrical shapes used in fertility figures.

Figure 17. The geometrical shapes used in eye-shaped figures

from the evil eye.

Geometrical shapes used in eye-shaped figures

This figure is obtained from 20-gon, hendecagons, octagons and triangles and is believed to be the best protector of human from the evil eye (Figure 17).

Geometrical shapes used in hobble figures

The pattern obtained by using geometric figures such as triangles, rectangles and trapezoids refers to keeping the family together, fondness of lovers, and the hope for being together (Figure 18).

Geometrical shapes used in hand, finger and comb figures

The hand, finger and comb figures obtained from parallel edges, trapezoids, triangles and line segments are believed to protect people from the evil eye (Figure 19). The hand figure symbolizes fertility and good luck. The comb figure is usually about marriage and giving birth.

Figure 18. The geometrical shapes used in Hobble figures

Figure 19. The geometrical shapes used in hand, finger and comb figures

Geometrical shapes used in hands on waist figures

The figure which contains so many geometric shapes on it such as triangles, equilateral quadrangles is the symbol of motherhood and fertility (Figure 20).

Geometrical shapes used in hair ribbon figures

The figures which consist of decagons, parallel edges, line segments and spiral curves stands for a woman's

Figure 20. The geometrical shapes used in hands on waist figures.

Figure 21. The geometrical shapes used in hair ribbon figures.

desire to get married (Figure 21).

Geometrical shapes used in Scorpion figures

As a result of their fear of scorpion toxin, people carry jewels that resemble scorpion or its tail so as to protect themselves from this animal. The scorpion figure created by using decagons, octagons, triangles and quadrangles is also used for this intention (http://www.cerezforum.com) (Figure 22).

Some rug examples

Figure 23 show samples of some rug designs found in Anatolian, Turkey.

CONCLUSION

This study shows us that ethnomathematics has an important place in mathematics education in historical-cultural field. The findings of the study revealed that Anatolian people has made use of mathematics in their lifestyles. Therefore, it will be reasonable to assume that the motifs in the rugs and carpets are the reflections of mathematical thoughts in the minds of Anatolian people.

Figure 22. The geometrical shapes used in Scorpion figures.

Figure 23. Examples of some rug.

The findings of the study might have many implications on mathematics education. Accordingly, it is possible to get the students to realize how societies do mathematics in their own cultures and their mathematical thoughts. The mathematical idea which will be obtained by doing this may be helpful for students to learn formal mathematics and to provide the skill of mathematization any kinds of future situations. Therefore, ethno-mathematics was regarded as a bridge among cultures.

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