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SYMMETRY AND INTERCULTURALITY

Iuliana Marchis

Abstract: Symmetry is one of the fundamental concepts in Geometry. It is a Mathematical concept, which can be very well connected with Art and Ethnography. The aim of the article is to show how to link the geometrical concept symmetry with interculturality. For this mosaics from different countries are used.

Keywords: interculturality, symmetry, Mathematics Education

1. Introduction

Symmetry is one of the fundamental concepts in Geometry. It is important to learn about symmetry by exploring things, which we use everyday but they are not necessary related to Mathematics (Knuchel, 2004). We see symmetry in nature and in things, which are made by people (furniture, buildings, cars etc.). Symmetry has an important role in problem solving, as it connects various branches of Mathematics, as Geometry, Algebra, Probability and Mathematical Analysis (Leikin, Berman & Zaslavsky, 2000).

Ethnomathematics is the study of the relation between Mathematics and culture. It is "the Mathematics, which is practiced among identifiable cultural groups such as national-tribe societies, labor groups, children of certain age brackets and professional classes" (D'Ambrosio, 1985). While teaching Mathematics using ethnomathematics the students learn not only mathematical concepts but also cultural elements.

In literature there are some articles about teaching symmetry using cultural elements. Eglash (2001) has presented a way to teach symmetry using traditional Shoshone-Bannock beadwork. Abas (2001) have shown how to teach symmetry by Islamic patterns. According to Pumfrey and Beardon (2002), Mathematics and Arts have strong links. Using beadworks, mosaics or architecture pieces while teaching, Mathematics could be very well connected with Arts or Ethnography. Dolinko (1996) has used flags from different countries to present the concept of symmetry, which approach connects Mathematics with Social Sciences.

There are projects on developing methodology for introducing interculturality and ethnomathematics in Mathematics classes. For example, the IDMAMIM (Innovation in Mathematical Didactics in Multicultural contexts with pupils from Minorities and Immigrants) project (2000-2005) had the main target to appropriate Mathematics with the intercultural reality.

The aim of this article is to show how to link the concepts of symmetry with interculturality.

2. Teaching symmetry using mosaics

To teach symmetry I have chosen photos of mosaics from different countries. In Figure 1 there are some examples. By this activity pupils learn not only about symmetry, but also about interculturality, History and Geography. In the following the details of the activity are presented.

The target group is 11-12 years old pupils.

Aims/competencies:

Related with symmetry, pupils have to be able to

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- identify symmetric figures (symmetric to a line, symmetric to a point);
- find the number of symmetry axis of a symmetric figure.

In the presented lesson we also want to develop intercultural competencies. Thus after the lesson pupils have to be able to

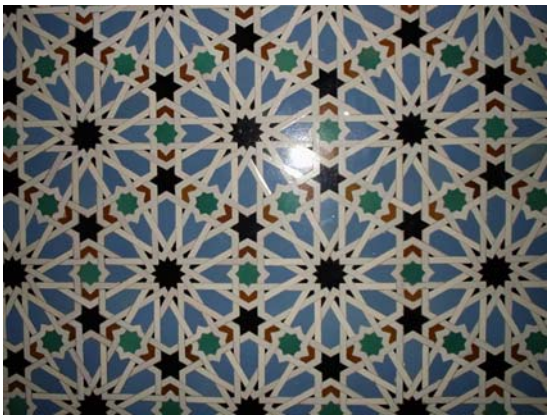
- recognize that there are connections between different cultures;
- show respect to other cultures;
- recognize intercultural relations.

Other competencies: after the lesson pupils have to be able to

- search for information on the Internet;
- make a presentation on a given topic.

Seville, Spain

Monastir, Tunisia



Seville, Spain

Monastir, Tunisia

Figure 1. *Examples of mosaics used*

Time: 100 minutes.

Resources: photos with mosaics, laptop, videoprojector, computer presentation made by the teacher (presentation about the Royal Palace in Seville, Spain and the Mausoleum in Monastir, Tunisia), a handout about symmetry (shapes symmetric to a line, shapes symmetric to a point, symmetry axis, etc), computer network with Internet connection.

Steps of the lesson: In the following the main steps of this lesson are presented. Some of the activities are Mathematics orientated, other are related with intercultural education. In some of the activities pupils are grouped in teams of two or three, in others they do individual work, and there are some steps, where frontal work with the whole class is organized. Let see the main activities on the lesson:

- Students group in teams of two or three. Each team gets a set of ten photos of mosaics from different countries (without knowing from where they are). They have to guess from where the photos are.
- The teacher shows a short computer presentation about the Royal Palace in Seville, Spain and the Mausoleum in Monastir, Tunisia from where the mosaics are.
- Every student chooses a mosaic, and then motivates to his/her team, why he/she has chosen that one (for example, he/she likes the colors, the patters, etc).
- Every student identifies known geometrical shapes on the chosen mosaic. For example, in Figure 2 we see the hexagon identified in the third mosaic of Figure 1, and the squares identified in the forth mosaic. Then they show to the others in the group which geometrical shapes they have found on their image. This activity can be done with images in printed format and pupils draw by hand on the photo, or, if they have enough knowledge in computer graphics, they can do it on the computer.

Figure 2. Identified polygons

- Every student gets and reads a short description about the symmetry: line symmetry and point symmetry.
- Every student tries to find symmetries on the chosen mosaic. As examples, see Figure 3. Students discuss in the group all the identified symmetries on all the chosen images.

Figure 3. Drawing symmetry axis

- Students discuss in the class, if there are similarities in the chosen images, and why these similarities appeared. Teacher helps with historical facts, as Arabian influence in Spain. This

discussion could lead to the conclusion, that the different cultures can be influenced by each other.
- Every group gets the name of an ethnic group, and they have to discuss, what they can learn from the culture of that ethnic group. They make a short computer presentation, for which they can search pictures and information on the Internet.
- Each group presents its work in front of the class.
- Students discuss in the class about what kind of intercultural relations could be between different cultures.

3. Learning symmetry by handcraft

Handcraft can be used to develop Mathematical skills.

The target group is 11-12 years old pupils.

Aims/competencies:

Related with symmetry, pupils have to be able to

- identify symmetric figures (symmetric to a line, symmetric to a point);
- find the number of symmetry axis of a symmetric figure;
- complete a line symmetric figure with respect to a horizontal/vertical line;
- make patterns using symmetry.

In the presented lesson we also want to develop intercultural competencies. Thus after the lesson pupils have to be able to

- recognize that there are connections between different cultures;
- show respect to other cultures;
- recognize intercultural relations.

Time: 100 minutes.

Resources: snowflakes made from paper (see Figure 4), laptop, videoprojector, computer presentation made by the teacher (presentation about beadworks in different cultures), a handout about symmetry (shapes symmetric to a line, shapes symmetric to a point, symmetry axis, etc), computer network with Internet connection, bead pattern designing software.

Figure 4. Snowflakes

Steps of the lesson: In the following the main steps of this lesson are presented. Some of the activities are Mathematics orientated, other are related with intercultural issues.

- Each student gets one snowflake made from paper and he/she have to find he symmetry axis and the symmetry point of it.
- Each student designs a pattern for a bead bracelet using special software (see Figure 5).
- Pupils form group of four and study the patterns made by the group members to find symmetries.

- The teacher shows a short computer presentation about bead bracelet patterns in different cultures.
- Students discuss how cultures interact, how people of different cultures living in the same community.

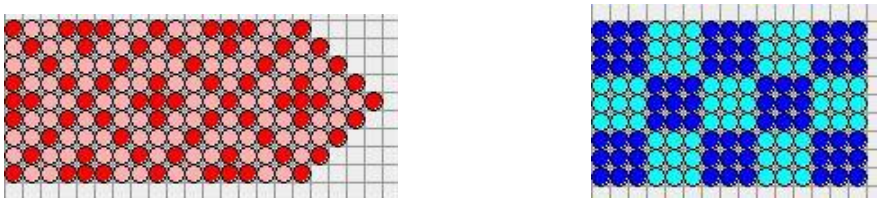


Figure 5. Patterns for bead bracelets

- The teacher shows the technique how to make a bead bracelet; pupils start to make their bracelets based on the designed patter.

Homework: Each student finishes the bracelet.

Conclusion

In the above presented activities pupils learn Mathematics in an attractive way, but also they are confronted by intercultural issues, they learn some Geography, Ethnography, History, and Arts too. Therefore these lessons are complex, uses the integrated teaching. The topic "symmetry" gives many opportunities to introduce intercultural issues to Mathematics lessons.

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Author

Iuliana Marchis, Babes-Bolyai University, Cluj-Napoca, Romania, e-mail: marchis_julianna@yahoo.com