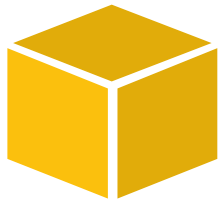


Hands-on Activities in Geometry for Middle School

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Brief description of workshop

We will demonstrate classroom-tested activities that address the geometry TEKS. We will model teaching strategies that are appropriate for the ELL in middle school and we will share some of our students' work. The participants will use manipulatives such as, geoboards, nets, and foldable 3-D models to make geometry concepts meaningful.

Background: Middle School Mathematics

Spatial Visualization

The National Council of Teachers of Mathematics in the Principles and Standards for School Mathematics recommends using hands-on activities with manipulatives to teach students basic concepts about geometry, particularly spatial visualization with three-dimensional figures. If students have the opportunity to build three-dimensional figures and explore the relationships among them, they will have a better conception of the basic structures of these figures and be prepared to understand relationships about them that are presented in a more formal context.

Problem solving

Geometry ([Greek](#) γεωμετρία; geo = earth, metria = measure) is a part of [mathematics](#) concerned with questions of size, shape, and relative position of figures and with properties of space. Geometry is one of the oldest sciences. Initially a body of practical knowledge concerning [lengths](#), [areas](#), and [volumes](#), in the third century B.C., geometry was put into an [axiomatic form](#) by [Euclid](#), whose treatment - [Euclidean geometry](#) - set a standard for many centuries to follow. The field of [astronomy](#), especially mapping the positions of the stars and planets on the celestial sphere, served as an important source of geometric problems during the next one and a half millennia.

How can ELLs learn mathematics successfully? [see Appendix A]
(From Hill & Flynn (2006). [Classroom instruction that works with English Language learners](#), ASCD publication)

Sheltered instruction is recommended as a medium for delivering math content knowledge to ELLs. This involves speaking slowly, using visual aids and manipulatives, and avoiding idioms

ELL students are very sociable (all middle schoolers are) and prefer to work in groups. They need to be monitored closely so that they stay on task and complete work in a timely manner.

Hands-on Activities

The participants will explore different shapes using geoboards, grid paper, colored tiles. They will use multiple representations to solve the given problems.

NET. A net is a two-dimensional representation of a three-dimensional object

A German artist named Albrecht Durer (1471 – 1528) was the first person to use the term “nets” to refer to the flat 2-D drawings of an unfolded polyhedron.

Pentominoes

A **pentomino** is a [polyomino](#) composed of five ([Greek](#) *πέντε* / *pente*) [congruent](#) squares, connected [orthogonally](#).

Each of the pentomino is named after a letter of the [Latin alphabet](#) that they resemble.

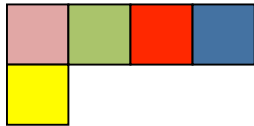
Note: [reflection symmetry](#) and [rotation symmetry](#) of a pentomino does not count as a different pentomino.

Source: <http://en.wikipedia.org/wiki/Pentomino>

1. Using color tiles to model a few examples

Use 5 color tiles to make different shapes.

Example:



1. For each figure, find the perimeter and the area. Make a list or table
2. Classify according to attributes (e.g., symmetric)
3. Determine which of the pentominoes could be folded into an open **box**.

2. Using Geoboards



Using a geoboard and rubber bands draw all of the different hexominoes.

Different means that one cannot be the reflection or rotation of another.

3. **Using grid papers** (the participants will trace shape and cut each shape. Then they fold the cut shape to test their predictions.

Hexominoes

Hexominoes are plane figures made up of 6 squares, each of which shares at least one side with a side of another square.

1. Using color tiles

Example:



1. Using Geoboards

Using a geoboard and rubber bands draw all of the different hexominoes. Different means that one cannot be the reflection or rotation of another.

1. For each figure, find the perimeter and the area. Make a list or table
2. Classify according to attributes (e.g., symmetric (bilateral, rotational))
3. Determine which of the hexominoes could be folded into a box



4. Using grid papers

Extension Activity

Growing Solids

Build the “double cube” and build the “double tetrahedron” to check your predictions. How many of the small cubes will fit in the “double cube”? How many small tetrahedrons will fit into the “double tetrahedron”?

PROBLEM: Candy works for the Chocdud Company. Currently the company markets Chocduds in two different-sized boxes. Candy has been bombarded with requests for a super-sized box and her boss agreed that she could produce a box that is twice the size of the large one. Her boss told her to double the order (used for the large box) for the candy and the cardboard to build the box. What should Candy tell her boss? Is “thank you” enough?

VOCABULARY BUILDING

(Discuss strategies)

ENGLISH

5. Earth
6. Euclidean geometry
7. Folded
8. Geometry
9. Length
10. Manipulatives
11. Measure
12. Reflection
13. Rotation
14. Share
15. Shape
16. Symmetry
17. Size
18. Space
19. Three-dimensional
20. Two-dimensional
21. Unfolded

SPANISH

Tierra
Geometria Euclidiana
Doblado
Geometria
Longitud, largo
Manualidades
Medida
Reflejo
Rotacion
Compartir
Forma
Simetria
Tamano
Espacio
Tridimensional
Dos dimensiones
Desdoblado

Participants' Reflection and Questions on the Workshop

References

Ideas were modified from lessons in *Build Up to Bubbles* by Art Johnson. Didax Educational Resources, Inc. 1997, Rowley, Massachusetts. (Geofix Shapes donated by Didax - NCTM Booth # 851)

Source: <http://en.wikipedia.org/wiki/Pentomino>

Source: <http://www.learner.org./channel/course/learningmath/geometry/keyterms.html>

For the Appendix, refer to next four pages 