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Ten Lessons the Arts Teach

By Elliot Eisner

The arts teach children to make good judgments about qualitative relationships. Unlike much of the curriculum in which correct answers and rules prevail, in the arts, it is judgment rather than rules that prevail.

The arts teach children that problems can have more than one solution and that questions can have more than one answer.

The arts celebrate multiple perspectives. One of their large lessons is that there are many ways to see and interpret the world.

The arts teach children that in complex forms of problem solving purposes are seldom fixed, but change with circumstance and opportunity. Learning in the arts requires the ability and a willingness to surrender to the unanticipated possibilities of the work as it unfolds.

The arts make vivid the fact that neither words in their literal form nor number exhaust what we can know. The limits of our language do not define the limits of our cognition.

The arts teach students that small differences can have large effects. The arts traffic in subtleties.

The arts teach students to think through and within a material. All art forms employ some means through which images become real.

The arts help children learn to say what cannot be said. When children are invited to disclose what a work of art helps them feel, they must reach into their poetic capacities to find the words that will do the job.

The arts enable us to have experience we can have from no other source and through such experience to discover the range and variety of what we are capable of feeling.

The arts' position in the school curriculum symbolizes to the young what adults believe is important.

SOURCE: Eisner, E. (2002). *The Arts and the Creation of Mind,* In Chapter 4, What the Arts Teach and How It Shows. (pp. 70-92). Yale University Press. Available from NAEA Publications.

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Ideas for Linking Math with Art

Geometric Shape Collages

Art Technique: collage Math Concepts: geometric shapes

Materials: geometric shapes for tracing (optional); colored construction paper in a variety of sizes; white or black construction paper, 9X12; scissors; glue sticks



Procedure: Cut and glue several shapes onto a background to make a picture or a non-representational design. Add some problem-solving:

Challenge for 1st grade:

one circle two lines three triangles four colors

Challenge for upper grades ...

one circle two lines or line segments three different kinds of triangles four quadrilaterals no more than five colors

Show movement with your design AND cover approximately half the area of the background.



Challenge for 2nd or 3rd grade...

one circle two lines an odd number of triangles an even number of rectangles less than fifteen total pieces no more than four colors

Overlap at least two shapes.

Add other artistic elements:

Cut the centers out of some of the shapes, following the contour to make an outline.

Overlap some of the shapes to show depth.

Do a rubbing of the design.

Draw the exact design on another sheet of paper.

Picasso-Inspired Geometric Faces

Art Technique: collage Math Concepts: geometric shapes; asymmetry

Materials: photo or print of Picasso's Self Portrait; black construction paper, 9X12; assorted bright-colored construction paper sheets, 6X9; scissors, glue



Procedure: Before doing the collage, post the Picasso print and ask students to observe closely to identify what shapes they can see, and talk about how the shapes are used. For the collage, cut and glue geometric shapes to create an asymmetrical abstract face

For younger students, use...

three or more triangles one circle one rectangle or square any other shapes you need

For older students, use...

any number of triangles, no two alike at least one polygon with no lines of symmetry two congruent figures any other geometric shapes you need

Geometric Figures

http://creatingartwithkids.blogspot.com/2008/11/geometric-figures.html

Art Technique: collage Math Concepts: geometric shapes; proportion

Materials: black construction paper, 9X12; assorted bright-colored construction paper sheets, 6X9; scissors, glue

Procedure: Cut geometric shapes



(circles, squares, triangles, rectangles, etc.) to make a human figure that shows movement. Option: Do a rubbing of the collage, and/or draw the design on a separate piece of white paper.

Symmetrical Face Collages

Art Technique: collage Math Concepts: geometric shapes; symmetry

Materials: black construction paper, 9X12; assorted bright-colored construction paper sheets, 6X9; scissors, glue Procedure: Cut and glue geometric shapes to create a symmetrical abstract face or non-representational design.

Mondrian-Inspired Drawings

http://creatingartwithkids.blogspot.com/2008/10/not-guite-mondrians.html

Art Technique: drawing Math Concepts: parallel lines, patterning, partitioning, creating rectangles

Materials: white construction paper, 9X12; black construction paper, 3x12; pencils; rulers; crayons; scissors, glue

Procedure: Draw three vertical lines and two horizontal lines

that extend off the edges of the paper. Fill some of the resulting shapes with colorful patterns. Cut narrow strips from the black construction paper, glue over the pencil lines, trim off edges.

Kandinsky-Inspired Drawings

http://www.share2learn.com/artmathsamples9.html

Art Technique: drawing

Math Concepts: geometric shapes and vocabulary; parallel lines

Materials: white construction paper, 9X12; assorted brightcolored markers; crayons

Procedure: Review vocabulary: edge, parallel, straight, curved, etc. as needed. Have assorted markers available for

students to change colors at will or by direction. Dictate to students, one element at a time, what to draw: i.e., three dots anywhere; two parallel lines that go off the edge of the paper; one line that intersects the first lines; a large circle; a curved line that begins at one dot and goes off the edge of the paper; two large triangles whose vertices touch the edges of the paper, etc. Color some of the closed shapes so that approximately half the area of the paper is in color.







More Math-Connected Art Activities

Shape Tracing

http://creatingartwithkids.blogspot.com/2008/11/shape-tracing.html

Art Technique: overlapping Math Concepts: geometric shapes

Materials: white construction paper, 9x12; cardboard shapes for tracing; pencils; crayons Procedure: Using only one cardboard shape,



trace and retrace just one cardboard shape repeatedly, overlapping the lines. Color in the resulting shapes as desired. For older students, fill the spaces with patterns or parallel lines. Cut around the contour and glue the design on a color that appears in the design.

Marshmallow & Toothpick Sculptures

http://creatingartwithkids.blogspot.com/2009/04/marshmallow-sculptures.html



Art Technique: sculpture Math Concepts: 3D / 2D comparison

Materials: mini-marshmallows; toothpicks; white drawing paper, markers

Procedure: Build a 3D structure with marshmallows and toothpicks. When finished, draw the structure on paper.

Line Landscapes

Art Technique: contour drawing Math Concepts: line segments and lines; curved and parallel lines; fraction estimation



Materials: white construction paper; pencils; fine- and medium-tipped permanent black markers; photographs of landscapes

Procedure: Have students look at a variety of photographs of landscapes. Use pencil to draw landscape contours, including details like trees, lakes, mountains, clouds, rocks, etc. The finished contour drawing should have many closed shapes and some lines should go off the paper. Trace over all the contours with a black marker, then fill about half the closed shapes with parallel and other lines. Mount on black construction paper.

<u>Sunflakes</u>

http://creatingartwithkids.blogspot.com/2010/05/sunflakes.html



Art Technique: collage Math Concept: radial symmetry

Materials: white construction paper, 9x12; yellow, orange, and red construction paper, 6x9; scissors; glue **Procedure:** From a yellow, red, or orange paper, cut three thin

strips. Arrange the strips on the white construction paper background so that they create six equidistant rays, then glue them down; cut small geometric shapes (6 or each) from red, orange, and yellow paper and glue onto the rays to create a "sunflake" design. For a literature connection, read Frank Asch's poem, *Sunflakes*.

Radial Squares

Art Technique: collage Math Concepts: patterning; ;measurement; radial symmetry

Materials: construction paper, two contrasting colors; scissors; glue **Procedure:** Trace or draw one small square on one color

construction paper. On a second color, make a square one-half inch larger. Make a third square on the first color one-half inch larger than the second. Continue making larger and larger squares using alternate colors until you have about ten squares. Glue the squares alternately onto each other, slightly rotating each square. Options: Use other geometric shapes, or use the series of squares to make designs other than symmetrical designs.

Symmetrical Positive/Negative Designs

http://creatingartwithkids.blogspot.com/2011/04/positive-negative-designs.html

Art Technique: collage Math Concepts: symmetry

Materials: two contrasting colors of construction paper, 9x12 background and 6x9 for cutting (2-sided) or 12x12 background and 6x6 for cutting (4-sided) ; scissors; glue

Procedure: For the simple 2-sided version, cut shapes from the smaller paper and position onto the background paper and glue. For the 4-sided Notan version, place the small square onto the center of the background square and mark the corners with pencil dots. Cut one shape from the small square at a time, lay the square down, glue the piece down to create the mirror image, then cut another shape, lay the square down and glue the next piece to create a mirrow image. Repeat as many times as desired.







Comparing Geometric Solids

Drawing Lesson

On a table where all students can see them, stack a few various-sized boxes. On the top, place a playground ball.

Talk with students about the edges, corners, and angles of the boxes, and have them identify the source of light and the location of shadows. Then have them observe the curve of the ball and the blending of light and shadow.

Lead students through a drawing lesson in which they work slowly to recreate the angles and shapes they see on the boxes and the ball. When drawing everyday objects, work slowly and observe carefully. Focus on lines and shapes. The trick is to draw what you actually see, rather than what you think you see.

When adding shadow, use the side of the pencil point or a series of light lines.

Drawing and Writing About Geometric Solids

Select two solids that are similar in some way.

On plain white paper, draw both solid figures. Pay close attention to proportion, faces, edges, angles, and shading.

Write a paragraph describing how the solids are similar and how they are different, using appropriate math vocabulary.

Domantha Patteria triangular-based pyramid 5940re-baren pyramid A triangular-based pyramid and a squarebased pyramid are different because the square based pyramid has four aides. They are also different sides. They are different because the square-tyramid has four sides. They a different because the triangular based of the square-there the triangular based of the triangular based of the the triangular based of the triangular based of the the triangular based of the triangular based of the the triangular based of the triangular bas pyramid has the sides. They a different because the triangular-based pyramid is skiny and tall. They are different because the square-based pyramid is fat and short. They are the same because they both are pyramids. They are the same because they have points at the top. The are the same because they all have

Standards for Mathematical Practice

<u>1. Make sense of problems and persevere in solving them.</u>

... plan a solution pathway rather than simply jumping into a solution attempt

2. Reason abstractly and quantitatively.

.... abstract a given situation and represent it symbolically

3. Construct viable arguments and critique the reasoning of others.

... construct arguments using concrete referents such as objects, drawings, diagrams, and actions.

4. Model with mathematics.

- ... a student might use geometry to solve a design problem
- ... (use) such tools as diagrams, two-way tables, graphs, flowcharts and formulas.

5. Use appropriate tools strategically.

... consider the available tools when solving a mathematical problem... pencil and paper, concrete models, a ruler, a protractor...

6. Attend to precision.

... try to communicate precisely to others...

7. Look for and make use of structure.

- ... look closely to discern a pattern or structure
- ... sort a collection of shapes according to how many sides the shapes have

8. Look for and express regularity in repeated reasoning.

... maintain oversight of the process, while attending to the details.

create an idea and devise a plan

use symbols to communicate ideas

communicate ideas visually

solve design problems visually

choose the best tools for the project

be thoughtful, careful, and creative

look for and use patterns and shapes

keep the big picture in mind and include necessary details



Excerpts from the Common Core State Standards

Art Ideas

Geometry - Kindergarten	
 Identify and describe shapes (squares, circles, triangles, rectangles, hexagons, cubes, cones,cylinders, and spheres). 	Geometric Shape Collage
- describe relative positions of objects (<i>above</i> , <i>below</i> , <i>beside</i> , etc)	Build with Blocks and Draw
- name shapes regardless of their orientations or size	
- identify shapes as 2D or 3D	Line Collage to
- compare two- and three-dimensional shapes	Create Snapes
- use informal language to describe similarities, differences, parts	Shape Tracing
- build shapes from components (e.g., sticks and clay balls)	Shape Drawing
- draw shapes	
- use simple shapes to form larger shapes	
Geometry - First Grade	
Geometry - First Grade - reason with shapes and their attributes	Geometric Shape Collage
Geometry - First Grade - reason with shapes and their attributes - distinguish between defining and non-defining attributes	Geometric Shape Collage Triangle Collage
Geometry - First Grade - reason with shapes and their attributes - distinguish between defining and non-defining attributes (e.g., triangles are closed and three-sided versus color, orientation, overall size)	Geometric Shape Collage Triangle Collage Build With Blocks and Draw
Geometry - First Grade - reason with shapes and their attributes - distinguish between defining and non-defining attributes (e.g., triangles are closed and three-sided versus color, orientation, overall size) - build and draw shapes to possess defining attributes	Geometric Shape Collage Triangle Collage Build With Blocks and Draw
 Geometry - First Grade reason with shapes and their attributes distinguish between defining and non-defining attributes (e.g., triangles are closed and three-sided versus color, orientation, overall size) build and draw shapes to possess defining attributes use 2D and 3D shapes to create a composite shape, and compose new shapes from the composite shape. 	Geometric Shape Collage Triangle Collage Build With Blocks and Draw Cut up Circle Collage
Geometry - First Grade - reason with shapes and their attributes - distinguish between defining and non-defining attributes (e.g., triangles are closed and three-sided versus color, orientation, overall size) - build and draw shapes to possess defining attributes - use 2D and 3D shapes to create a composite shape, and compose new shapes from the composite shape. - partition circles and rectangles into two and four equal shares and describe using "fraction" language	Geometric Shape Collage Triangle Collage Build With Blocks and Draw Cut up Circle Collage Circle and Line Designs

Geometry - Second Grade	
- reason with shapes and their attributes	Goomotria Poopla
- recognize and draw shapes having specified attributes	Geometric People
- identify triangles, quadrilaterals, pentagons, hexagons, and cubes	Graph Paper Design
- partition a rectangle into rows and columns of same-size squares	
 partition circles and rectangles into two, three, or four equal shares 	Mondrian-type
- describe shares using the words <i>halves</i> , <i>thirds</i> , <i>half of</i> , <i>a third of</i> , etc.	Design
 recognize that equal shares of identical wholes need not have the same shape. 	
Geometry - Third Grade	Geometric Face
Geometry - Third Grade - reason with shapes and their attributes	Geometric Face Collage
Geometry - Third Grade - reason with shapes and their attributes - understand that shapes in different categories may share attributes (e.g., rhombuses, rectangles, and others; having four sides	Geometric Face Collage Kandinsky-type Drawing
Geometry - Third Grade - reason with shapes and their attributes - understand that shapes in different categories may share attributes (e.g., rhombuses, rectangles, and others; having four sides - recognize that the shared attributes can define a larger category (e.g., quadrilaterals).	Geometric Face Collage Kandinsky-type Drawing Picasso-type Face Collage or Drawing
 Geometry - Third Grade reason with shapes and their attributes understand that shapes in different categories may share attributes (e.g., rhombuses, rectangles, and others; having four sides recognize that the shared attributes can define a larger category (e.g., quadrilaterals). recognize rhombuses, rectangles, and squares as examples of quadrilaterals, and draw examples of quadrilaterals that do not belong to any of these subcategories 	Geometric Face Collage Kandinsky-type Drawing Picasso-type Face Collage or Drawing

Geometry - Fourth Grade		
- draw and identify lines and angles	Kandinsky-type Drawing	
- classify shapes by properties of their lines and angles	Mondrian-type Drawing	
- draw points, lines, line segments, rays, angles	Geometric Collage	
- draw perpendicular and parallel lines and identify them in two- dimensional figures.	Symmetrical	
 classify two-dimensional figures based on the presence or absence of parallel or perpendicular lines, or the presence or absence of 	Bilateral and Radial Symmetrical Designs	
- recognize right triangles as a category, and identify right triangles	Eolded Paintings	
- recognize a line of symmetry for a two-dimensional figure	Folded Failtings	
- identify line-symmetric figures and draw lines of symmetry.		
Geometry - Fifth Grade		
- graph points on the coordinate plane	Coordinate Graph	
distinguish among restangles, perellolograms, and transpoids	Designs	
- distinguish among rectangles, parallelograms, and trapezolos		
- classify two-dimensional figures in a hierarchy based on properties		
 - distinguish among rectangles, parallelograms, and trapezoids - classify two-dimensional figures in a hierarchy based on properties - use formulas for the area of triangles and parallelograms and compare them to area of a rectangle 	Geometric Shape Collage (with extensions)	

Selected Resources for Art/Math Integration

<u>Books</u>

Creating Art With Kids. Renee Goularte, 2006.

A collection of easy, open-ended art explorations based in the elements of design. Available directly from the author: http://www.share2learn.com/CreatingArt-info.html

Drawing With Children. Mona Brooks.

Jeremy P. Tarcher, Inc.; 1986. Drawing ideas and guidelines for teachers and students.

Lively Learning: Using the Arts to Teach the K-8 Curriculum. Linda Crawford.

Northeast Foundation for Children; 2004. Guidelines and ideas for using the arts across the curriculum.

On the Internet

Share2Learn ~ Student art work ~ Linking Math With Art

http://share2learn.com/artmathsamples.html

Creating Art With Kids blog

http://creatingartwithkids.blogspot.com/ Lesson descriptions for many art activities that have math-related concepts.

Draw a Math Story ~ Read-Write-Think lesson by Renée Goularte

http://www.readwritethink.org/lessons/lesson_view.asp?id=144 Complete lesson plan for drawing math stories.

More Than Math

http://www.morethanmath.org/index.htm Art-related interactive activities.

Math Cats

Math Art Gallery: http://www.mathcats.com/gallery.html

mathartfun.com

http://www.mathartfun.com/shopsite_sc/store/html/index.html Resources for integrating math and art

Fractals: A Fractals Unit for Elementary and Middle School Students

http://math.rice.edu/~lanius/frac/

All about fractals, including examples and lessons which are available in print versions for classroom use. Step by step illustrated directions for making Sierpinski Triangles, Koch Snowflakes, Anti-Snowflakes, and more.



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