

STEM + ARTS = SUCCESS

Myra Demeter, Ph.D.
Demeter Educational Consulting LLC
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Why Infuse the Arts?

- Investment in the arts is essential in STEM research, discovery and innovation that pays off for decades to come.
- Max Planck, a 1918 Nobel Laureate said, "The creative scientist needs an artistic imagination."
- Enhances skills that expand abilities
 - Root-Bernstein research on Nobel prize winners and MSU honors STEM graduates
 - Highest performers, most successful professionals participate in the arts at greater percentage than peers.
 - Arts benefits persist beyond high school-the more arts that scientists, engineers and entrepreneurs engage in across their lifetimes, the greater the likelihood of achieving important results in the workplace.
 - Nobel prize winners 15-20x more likely than average to engage in the arts
 - If individual does not participate in the arts as a child there's only 5% chance he will take up art as adult.
- Nobel Laureates
 - Hans von Euler-Chelpin (1929) chemistry. Studied arts in college.
 - Luis Alvarez (1968) physics. Studied arts and crafts, industrial drawing and woodwork.
 - Einstein (1921) physics. Talented in violin and piano. Cantoni school (Switzerland) encouraged visualization, individual differences. Einstein attributed his success to musical perception.

Infusing the Arts in Academia promotes and strengthens

- Creativity/personalization
- Problem solving/critical thinking
- Interdisciplinary project learning
- Analyzing and synthesizing
- Observation
- Visual Thinking-best predictor of K-16 success in science. Students who excel in math and science outperform even arts majors in visual memory and imaging
- Recognizing and Forming Patterns
 - Selected Programs
 - Chicago (Summer of Learning) , Atlanta (Drew Charter School) , Puget Sound Ed Services District (RTT \$40mil) , Miami-Dade County, FL (RTT \$30 mil) , St. Vrain Valley School, Colorado (RTT \$16.6mil)

Tessellations

Tessellations: complete covering of a plane by one or more figures in a repeating pattern. Figures meet at a common vertex.

- Polygonal Tessellation
- Regular tessellation
- Semi-regular tessellation

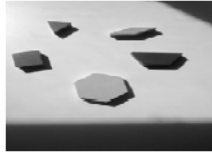
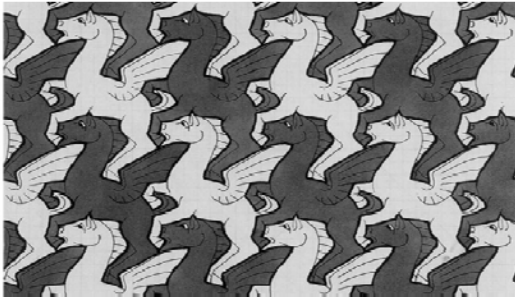
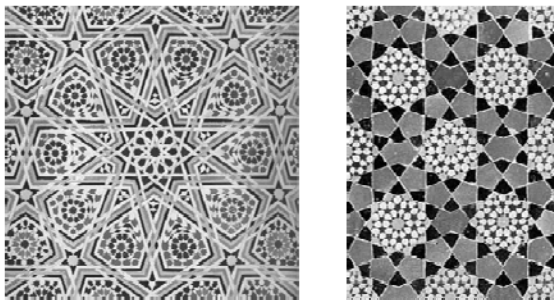


Fig 1: Pattern Blocks for tactile exercise.

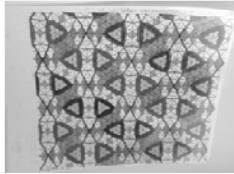
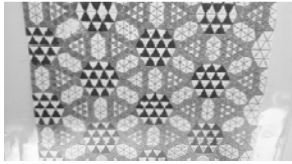
Tessellations in the Art World



Tessellations in the World of Islamic Art



Tessellation Grid Exploration



How to Translate a Polygon

- Start with a polygon
- Mark from edge to edge, cut, slide, attach to opposite side
- Repeat with adjacent side
- Trace the outline of the new figure to cover the surface
- Individual interpretation with colors

Mathematical Concepts in Tessellations

- Congruence
- Polygons
 - Regular polygons
 - Sum of the interior angles of a polygon
 - Each interior angle of a regular polygon
- Area
- Transformational geometry
 - Translation
 - Rotation
 - Symmetry
 - Reflections

Hawaiian Quilts

The African Tulip



- Incorporate cultural and historical elements into the design
- Traditional patterns are handed down
- Inspiration for the design is from one of three things – an event, place or person who was significant in the life of the quilter
- At periods it reflected the political climate
- Transmitted system of beliefs
- Often quilts have a hidden meaning, or “kaona”
- The “kaona” does not necessarily relate to the design
- The meaning may never become known to an outsider
- Secret significance makes it very personal

Elements of the Hawaiian Quilt

- Usually a two-color design
- Derived from fold and cut method
- Design is planned from 1/8 fold which opens to form the design
- The design is “envisioned” and very few people have this skill
- “Piko” or center design , lei or outer design
- Quilts are symmetric and balanced

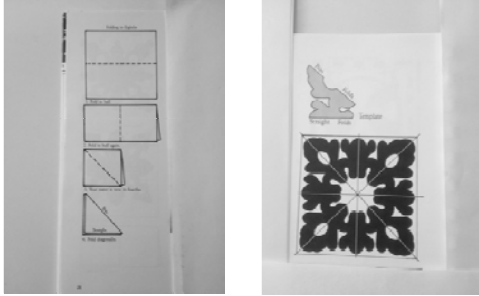
The Mathematics of Hawaiian Quilts

Transformational geometry in Quilts

- Line Symmetry
- Reflection
- Rotational Symmetry



Eighth Fold and Cut



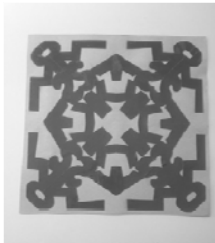
Art, Mathematics and Writing Project

- Materials needed:
- Square paper colored on one side
 - Pencil
 - Scissors
 - Contrasting background paper
 - Writing tool or computer

Process

- Fold square into eighths
- Mark area to be cut along the folds
- Cut
- Open
- Write personal statement

Hawaiian Teachers' Paper Quilt Design



"This design signifies my family tree. Included are the first letters of all the members in my immediate family, as well as the first letter of our last name – Kimura. The R is for Russell, my husband, S for Shirley, that's me, and the K. On the side are the letters, L for Lori, my daughter, and W for Wade, my son.
If you look at the design, the round circles at each corner represent the 4 individuals."

-S.K.

Relating quilts to students' lives

Memory



"A memory that my family and I is when my sister and I were roughhousing and I fell on a chair and cut myself above the eyebrow and had to get 12 stitches, six inside and six outside."

- A.F., 4th grader

Resources

- The STEAM Journal
<http://scholarship.claremont.edu/steam/>
- RISD
STEMtoSTEAM.org
- John F. Kennedy Center
<http://artsedge.kennedy-center.org>

Questions?

Thank you for joining me on this journey.

Myra Demeter, Ph.D.
myrad@demeterec.com
310.279.6930
