

# Using Art to Teach and Assess Geometry Concepts

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# I SEE, I THINK, I WONDER

A Thinking Routine from Harvard's  
Project Zero Artful Thinking Routines

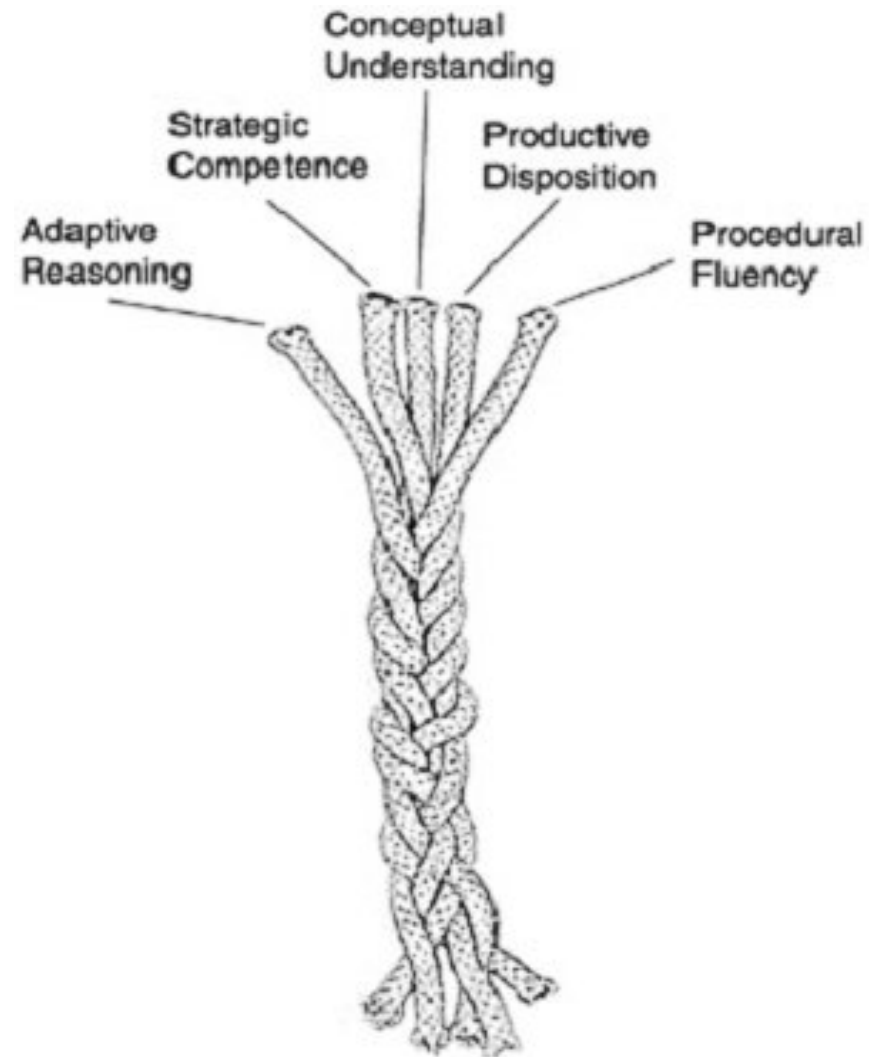


Twenty-Four Triangles by Ronald Davis

“Mathematics, rightly viewed possesses not only truth, but supreme beauty – a beauty cold and austere, like that of sculpture, without appeal to any part of our weaker nature, without the trappings of paintings or music, yet sublimely pure, and capable of stern perfection such as only the greatest art can show.”

- Bertrand Russell

Intertwined Strands of Proficiency from *Adding + It Up: Helping Children Learn Mathematics* (2001) from the National Research Council



# Problem-Based Tasks

“Most, if not all, important mathematics concepts and procedures can best be taught through problem solving.”

- John Van de Walle

*Teaching Student-Centered Mathematics*

# What is a Problem

“A problem is defined... as any task or activity for which the students have no prescribed or memorized rules or methods, nor is there a perception by students that there is a specific correct solution method.”

- James Hiebert et al.

*Making Sense: Teaching and Learning  
Mathematics with Understanding*

# Problem-Based Tasks: Lesson Structure

1. An introduction to the problem
2. Time for students to play with the math and explore paths to solutions or different solutions with scaffolding and differentiation as necessary
3. Time for students to discuss their work and thus construct their own meaning



# Problem-Based Tasks

- The problem must begin where the students are
- The problematic or engaging aspect of the problem must be due to the mathematics that the students are to learn
- The problem must require justifications and explanations for answers and methods

– From *Teaching Student-Centered Mathematics* by John Van de Walle and LouAnn H. Lovin

# Problem-Based Task

- Create a work of art that illustrates the following common core standard:
- 8.G.2. Understand that a two-dimensional figure is congruent to another if the second can be obtained from the first by a sequence of rotations, reflections, and translations; given two congruent figures, describe a sequence that exhibits the congruence between them.
- Write a description to accompany your artwork to explain how the work illustrates your concept.

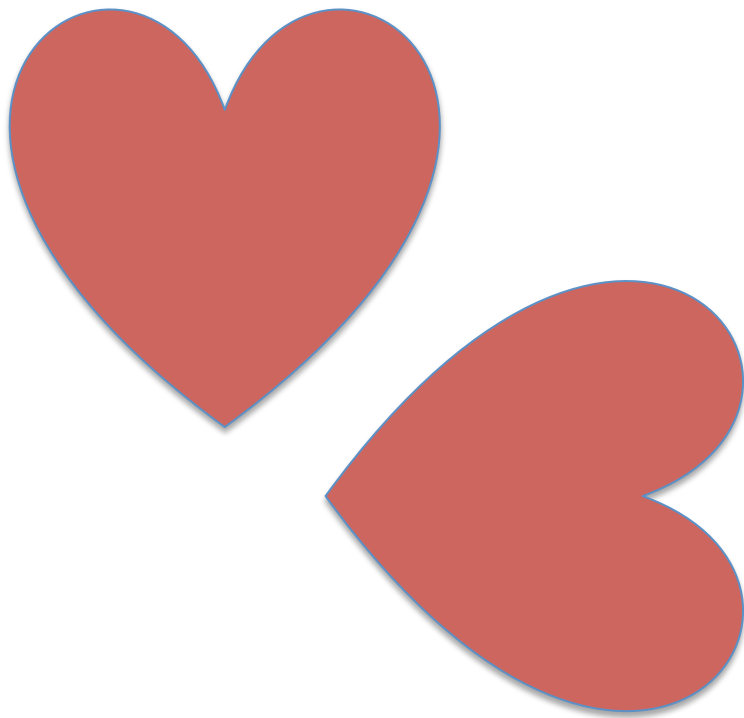
# K-W-C-I

What We KNOW	WHAT We Need to Find Out	CONDITIONS that make this problem tricky	IDEAS for solving the problem

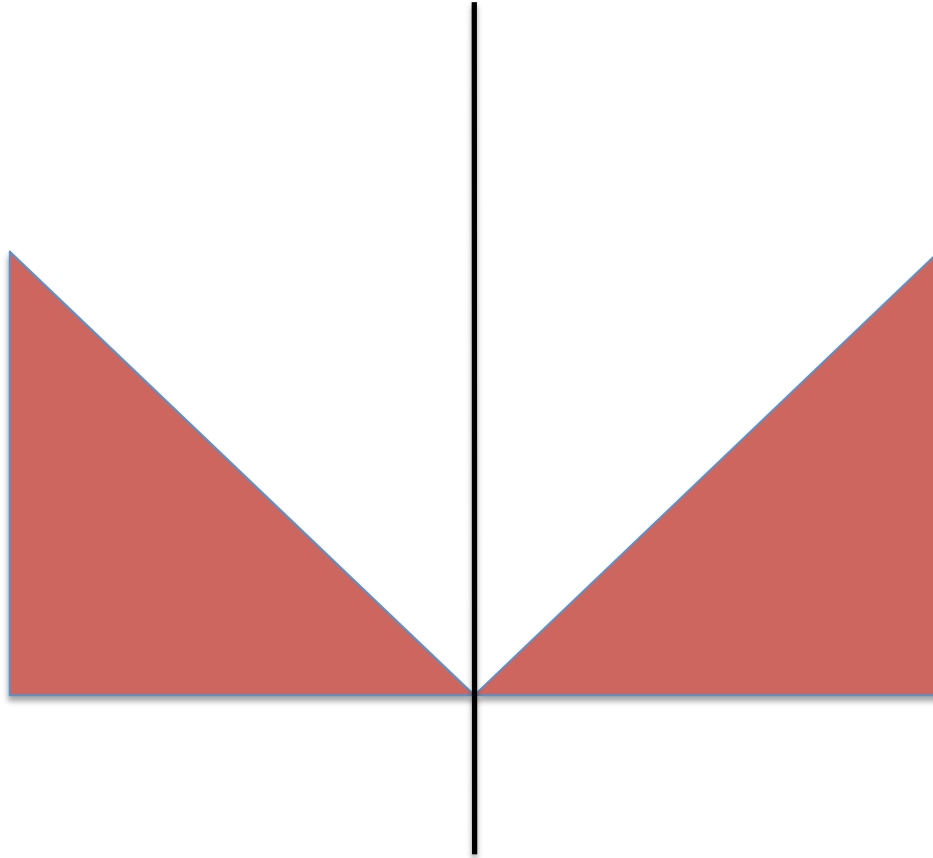
# Four Geometry Concepts

1. Shapes can be classified based on attributes
2. Objects can be located in space
3. Objects can be moved in space
4. Shapes can be represented in multiple ways

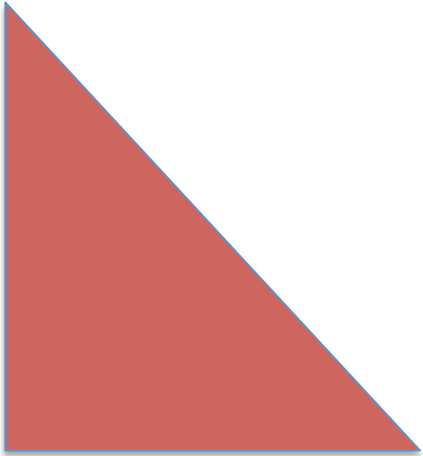
# ROTATION

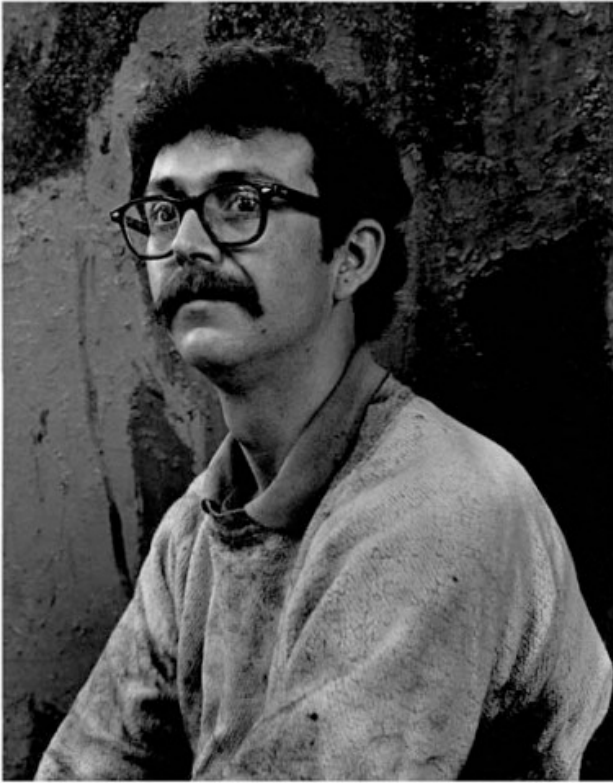


# REFLECTION



# TRANSLATION





Ronald Davis

Born: Santa Monica CA, 1937

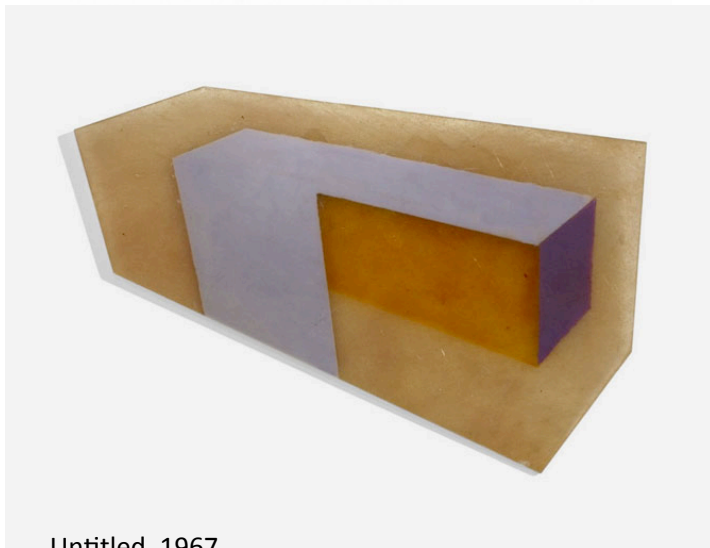
Lives and works in Arroyo Hondo, NM

<http://irondavis.com/>

-geometric paintings

-Illusion of depth

-inspired by Duchamp's perspective studies



Untitled, 1967

Polyester resin and fiberglass, 6 in x 10 in



Marcel Duchamp, Nude descending Staircase, 1912





***Twenty-Four Triangles***, 2009, Acrylic on Expanded PVC, 20 x 20 x 2 1/2 inches,



**Triangle Twist**, 2009, Acrylic on Expanded PVC, 20 x 20 x 3 inches,



Todd Chilton

Born: Chula Vista, CA. 1977

Lives and works in Chicago, IL

<http://www.toddchilton.com/>

-geometric abstractions

- inspired by New York

Abstractionists Mary Heilman and

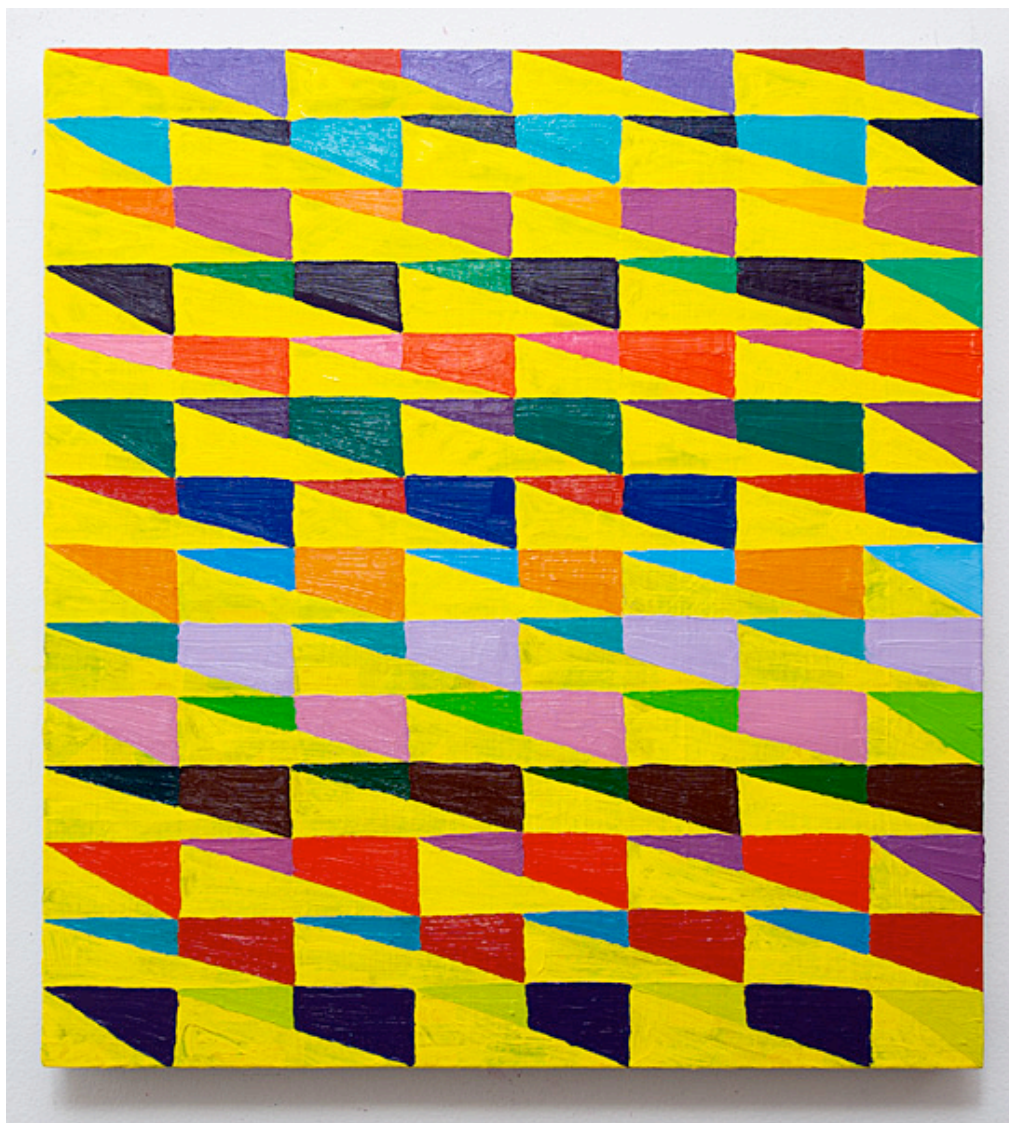
Thomas Nozkowski



Thomas Nozkowski, **Untitled (N-9)**, 2010



Mary Heilmann, **Primalon Ballroom**, 2002



Todd Chilton  
Ramps and Flags, 2011. oil on linen, 25" x 23"



Todd Chilton

Kites, 2009. oil on canvas, 60" x 48"

- Create your own original work of art that demonstrates transformations of congruent shapes on the plane.
- Write a brief explanation of how you utilized the geometry concepts.
- Be prepared to share your work at your table.

# ASSESSING GEOMETRY THROUGH ART

- Artwork gives an authentic reason to use the geometry concepts
- Artwork thus provides an opportunity for self-expression while experimenting with both how to apply math concepts and communicate about them

## GEOMETRY AND ART RUBRIC

	BEGINNING - 1	ACCOMPLISHED - 3	EXEMPLARY - 5
<b>APPLICATION OF MATHEMATICS AND ACCURACY</b>	<p>The work:</p> <ul style="list-style-type: none"> <li>- does not demonstrate use of the geometric concepts</li> <li>- demonstrates little care in the measurement of angles, lengths, and proportions.</li> </ul>	<p>The work:</p> <ul style="list-style-type: none"> <li>- does demonstrate correct use of the geometric concepts</li> <li>- demonstrates care in the measurements of angles, lengths, and proportions</li> </ul>	<p>The work:</p> <ul style="list-style-type: none"> <li>- demonstrates a unique application of more than one geometric concept.(Consider original ways to apply concepts not seen in models.)</li> <li>- demonstrates extra care in measurements of angles, lengths, and proportions</li> </ul>
<b>MATHEMATICAL COMMUNICATION</b>	<p>The explanation:</p> <ul style="list-style-type: none"> <li>- does not make sense</li> <li>- is missing important steps</li> <li>- lacks clear reasons why certain steps were taken</li> </ul>	<p>The explanation:</p> <ul style="list-style-type: none"> <li>- accurately describes the process of creating the art work</li> <li>- clearly connects the information in the problem and the geometry concepts to the artwork</li> <li>- makes use of appropriate terminology</li> </ul>	<p>The explanation:</p> <ul style="list-style-type: none"> <li>- accurately describes the solution process</li> <li>- clearly connects the information in the problem and the geometry concepts to the artwork</li> <li>- makes use of sophisticated terminology</li> <li>- is concise</li> <li>- is precise</li> </ul>
<b>PRESENTATION</b>	<p>The work:</p> <ul style="list-style-type: none"> <li>- has stray marks.</li> <li>- has no evidence that a straight edge, compass, protractor, or a stencil was used in the final draft.</li> <li>- Has lines and shapes placed with little regard to aesthetic value.</li> </ul>	<p>The work:</p> <ul style="list-style-type: none"> <li>- Is generally neat however there may be lines from where the artist didn't fully erase marks.</li> <li>- Has too much white space or too little making the work look unbalanced</li> <li>- Has lines and shapes that are not all placed intentionally in the space. Some lines and shapes are straight and neat. Others are not.</li> </ul>	<p>The work:</p> <ul style="list-style-type: none"> <li>- demonstrates care in creating the final draft. There are no stray marks on the paper.</li> <li>- Is framed on the sheet. White space is used intentionally.</li> <li>- has lines and shape placed intentionally.</li> <li>- Demonstrates that a straight edge, protractor, compass, or stencil was used for each shape.</li> </ul>



**SHARE YOUR ARTWORK**

# QUESTIONS?

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