

**Title:** The “Wright” Way of Creating Stained Glass Windows

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**Subject:** Math/ Learning Strategies for ESE students

**Course:** Pre-Algebra/Algebra or Learning Strategies Class

**Grade Level:** 8<sup>th</sup> grade

**Learning Schedule:** This lesson would coincide with the geometry unit, especially after the study of tessellations, rotations, reflections and the common core standards indicated below. This would serve as enrichment for most students, but might be reinforcement of skills for exceptional education students.

Note: This lesson assumes that the student already has learned how to manipulate geometric shapes on a grid or coordinate plane. The purpose of this lesson is to enrich the ability to do so while creating a Frank Lloyd Wright inspired stained glass window.

**Duration of lesson:** 2-3 ninety minute class periods, depending on student ability- most students should finish in 2 days.

**Common Core Standards:** Math 8<sup>th</sup> grade

**CCSS.Math.Content.8.G.A.1** Verify experimentally the properties of rotations, reflections, and translations:

**CCSS.Math.Content.8.G.A.1a** Lines are taken to lines, and line segments to line segments of the same length.

**CCSS.Math.Content.8.G.A.1b** Angles are taken to angles of the same measure.

**CCSS.Math.Content.8.G.A.1c** Parallel lines are taken to parallel lines.

**CCSS.Math.Content.8.G.A.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.

**CCSS.Math.Content.8.G.A.3** Describe the effect of dilations, translations, rotations, and reflections on two-dimensional figures using coordinates.

**CCSS.Math.Content.8.G.A.4** Understand that a two-dimensional figure is similar to another if the second can be obtained from the first by a sequence of rotations, reflections, translations, and dilations; given two similar two-dimensional figures, describe a sequence that exhibits the similarity between them.

**CCSS.Math.Content.8.G.A.5** Use informal arguments to establish facts about the angle sum and exterior angle of triangles, about the angles created when parallel lines are cut by a transversal, and the angle-angle criterion for similarity of triangles. *For example, arrange three copies of the same triangle so that the sum of the three angles appears to form a line, and give an argument in terms of transversals why this is so.*

**Goal or Objective of Lesson:**

Following previously taught lessons on the common core standards listed above, the student will

~ create a geometrically patterned stained glass "window" following the Frank Lloyd Wright models of windows, using a minimum of 4 geometric shapes and 4-5 colors.

~ demonstrate knowledge of rotations and movement of geometric shapes

~ explain the rationale behind the choices used for the creation of the window

### **Materials/Resources:**

Powerpoint of stained glass windows – include Frank Lloyd Wright/Prairie School, geometric, or local windows in the powerpoint; 1" grids on 8 ½ by 11 inch paper, wax paper cut to same dimensions, scissors, black crayons or craypas, black sharpie, rulers, tissue paper of various colors, construction paper (the teacher should have pre-cut various colors of geometric shapes for those who have difficulty with eye/hand coordination), glue or glue stick, baggies, geometric tile shapes for those students who need extra assistance. Also include: *Frank Lloyd Wright Designs Sticker book* (Pomegranate Kids ISBN 978-0-7649-6344-5) and *Stained Glass Window Designs of Frank Lloyd Wright* rendered by Dennis Casey, Dover Publications ISBN 0-486-29516-8. Other resources or materials might include any other media available in your community that include photographs or illustrations of stained glass and a camera for capturing possible window choices.

### **Warm-up/Bell Ringer**

1. Review with the students the basic geometric shapes and movement techniques from the standards above that they will use in the window.

2. Present the PowerPoint that focuses on the various types of FLW windows and also examples of geometrically patterned windows. Show a teacher created window created from the same materials the students will use. After the warm-up, place examples of windows around the room for the students to use as a reference.

3. Show the students the window templates from *Stained Glass Window Designs of Frank Lloyd Wright*. (For ESE students with extreme eye-hand coordination difficulties, allow them to use one of these templates to create their own design) Also allow the sticker book to be used as a model of various types of geometric shapes for their windows.

### **Work Period (day 1)**

Follow these steps:

1. Distribute the graph paper and either construction paper or 3-D geometric shapes and/or tiles. Allow students to take the time to manipulate the shapes/tiles into the final design they desire. Take photos of the various designs created so that the students may choose their final design.

2. Once students have selected their chosen design, allow them to create the same shapes out of the tissue paper – for students who have difficulty with drawing and/or cutting, allow them to use construction paper shapes. Using the rulers and scissors, students should create the same geometric shapes that they have on their graph paper design.

3. At the end of the period, have students put all materials into their baggie for completion on day 2.

4. As a class, discuss the trials and successes of creating the window.

**Work Period (day 2 - and day 3, if needed)** – these days are used for completing the windows and, on the final day, creating a window gallery

1. Redistribute baggies, graph paper, wax paper, glue, ruler and black sharpie, crayon or craypa, printed picture of the student's final design.
2. Place the wax paper on top of the graph paper. Allow the students to recreate their rough draft from yesterday onto the wax paper, using the tissue pieces they cut out or the construction paper pieces that had been pre-cut by the teacher. Glue all the pieces to the wax paper.
3. Using the ruler and black marker, create lines between all of the shapes. Be sure to include a border around the edge of the window. NOTE: For students, who cannot cut out, allow them to use craypa or crayons to create the shapes/colors on the wax paper and then have them fill in with the black marker.
4. When all students are finished, hang the windows on a classroom window as a gallery exhibit. Students will explain their art piece to a visiting group of students from another class, including their reasoning for selecting their shapes, patterns and colors. The visiting students will then take a sticky note and place it on their favorite window. On the sticky note, the students should write:
  1. one specific reason why this is their favorite window
  2. one positive comment on the student's work
  3. put their name on the back of the sticky note

**Closing** – closing for days 1 and 2 (if 3 day) would be a 5-10 minute discussion of trials and successes in creating their window designs. The closing for the final day would be the hanging of the windows in gallery style and having the visiting students do a sticky note critique for their 3 favorite designs.

**Homework:** Not necessary for this lesson; however, students may choose to create a window design for their bedroom or other room in the house and work at home to design a geometric window for home.

**Differentiated Instruction:** Most of the differentiation is listed in each of the sections above. For additional differentiation, students may choose to create their own PowerPoint or computer generated stained glass windows. Students who use an eye gaze device would find this a more appropriate application of the lesson.

**Technology Integration** – the computer use for the PowerPoint and any additional slides used in the warm-up. Additionally, students may also use technology to create computer-based window images or to make their own PowerPoint presentations.

**Assessment:** Students would be assessed by the completion of the window based (on their ability) and their presentation to the visiting students. The attached rubric would be used to assess the final outcome of the assignment.

## Rubric for Stained Glass Window Project

CATEGORY	4	3	2	1
<b>Creativity</b>	Several of the shapes and colors used in the window reflect an exceptional degree of student creativity in their creation and/or display	One or two of the shapes and colors used in the window reflect student creativity in their creation and/or display.	One or two shapes and colors were made or customized by the student, but the ideas were typical rather than creative	The student did not make or customize any of the items on the window.
<b>Number of geometric shapes used</b>	The window includes 4 or more different shapes.	The window includes 3 different shapes.	The window includes 2 different shapes	The window contains fewer than 2 different shapes.
<b>Design</b>	Shapes are trimmed to an appropriate size and interesting shape and are arranged well, some in front and some behind. Care has been taken to balance the shapes across the paper.	Shapes are trimmed to an appropriate size and interesting shape and are arranged with some items in front and others behind. The paper however does not appear balanced.	Shapes have been trimmed to an appropriate size and shape, but the arrangement of items is not very attractive. It appears there was not a lot of planning of the item placement.	Shapes are untrimmed OR of inappropriate size and/or shape. It appears little attention was given to designing the window.
<b>Number of colors used</b>	The window includes 4 or more colors, each different.	The window includes 3 different colors.	The window includes 2 different colors	The window contains fewer than 2 different colors
<b>Presentation of final window</b>	Explanation is vivid and completely describes the process.	Student gives some description of the process, but includes choices for all shapes/colors	Student gives a minimal explanation of just colors/shapes used	Student does not give a presentation of the final window

Student name \_\_\_\_\_

Score: (Circle score for each category)

<b>Creativity</b>	4	3	2	1
<b>Number of shapes</b>	4	3	2	1
<b>Design</b>	4	3	2	1
<b>Number of colors</b>	4	3	2	1
<b>Presentation</b>	4	3	2	1

**Total Score:** \_\_\_\_\_ x 5 = \_\_\_\_\_ (final grade)