Creating Rubik's Art

Common Core: Without matching this to specific standards, this block of activities involves creativity, collaboration, cooperation, computer skills, photo editing, blueprinting, and pattern recognition.

Objectives: 1) Students will be able to replicate color configurations on one face of a Rubik's® Cube.

2) Students will design their own 81-pixel picture/pattern, and then replicate it using 9 Rubik's Cubes.

3) Students will gain exposure to photo editing, and will use two particular programs to create larger-scaled Rubik's mosaics.

Materials:
Crayons/markers/colored pencils
Scissors
Rubik's Cubes (more cubes means larger mosaics and more detail)
*can be borrowed through YouCanDoTheCube.com
Practice & Pixelate worksheet
Building a Mini Mosaic worksheet
Designing a Rubik's Mosaic using Gimp worksheet (
Designing a Rubik's Mosaic using Twist the Web worksheet (
Computers, with Gimp 2 software installed (free software)
Computers, with Internet access (specifically Google Chrome)
Printer (optional)

Procedure: 1) With the Practice & Pixelate worksheet and a Rubik's Cube, have students complete tasks #1-2.

2) As a class, discuss responses to #2 and share strategies.

3) Have students get some coloring utensils (only yellow, blue, orange, red, and green) and draw a picture or pattern for #3. I recommend having extra copies of this worksheet ready in case any students make mistakes, want to start over, or want to draw a second picture/pattern.

4) Students transfer their picture/pattern onto the Building a Mini-Mosaic worksheet. Then they cut out the 9 3x3 squares.

5) When a number of students are ready, group them together, give the group 9 Rubik's Cubes, and have them help each other build their mini-mosaics. *Your group sizes depend on access to Rubik's Cubes. Take the number of Rubik's Cubes you have and divide that by 9. That is how many groups you can have.

6) Students will log onto a computer that contains Gimp 2. They will then follow the instructions on the Designing a Rubik's Mosaic using Gimp worksheet. *If computers are limited, pair students up and have them do it together. *Depending on time and classroom management, you may want to set expectations on step #1, "getting a picture".

7) Now that students have experienced the photo editing needed to create a Rubik's mosaic, they will use a web-based program that does a little more of the work for them. They will need a computer with internet access through Google Chrome and the Designing a Rubik's Mosaic using Twist the Web worksheet. Students will follow the instructions on the worksheet to create a Rubik's mosaic. *For #9, you may want to instruct students to save their work instead of printing, because printing uses a lot of paper.

8) Show the class some of the art made using Twist the Web. Have students vote on one, print the blueprint for the mosaic, and have the class work together on building it. *Art designed on Gimp 2 can be used, but it won't print in a nicely blueprinted format like Twist the Web.

Notes to Teacher:

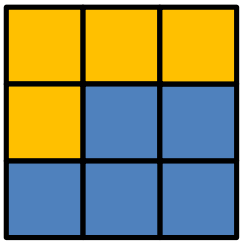
Some of my students tend to spend too much time looking for (or taking) pictures to use when making mosaics with Gimp and Twist the Web. Again, setting expectations about how long they have to take or find a photo (and even what the photos can contain) will help keep students on task.

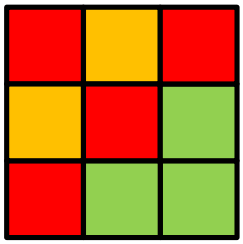
Students will find out that some pictures transform into Rubik's mosaics better than others. Pictures with a lot of colors, lots of details, and small main objects tend to transfer poorly. I will, sometimes, steer students to cartoon or clip-art pictures.

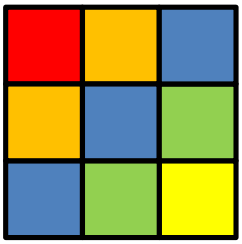
Gimp 2 software can be downloaded at:
https://www.gimp.org/downloads/

Practice & Pixelate

1) Try to make one of the faces of your Rubik's® Cube match each of the following configurations. (It is not possible to have them all completed at the same time.)

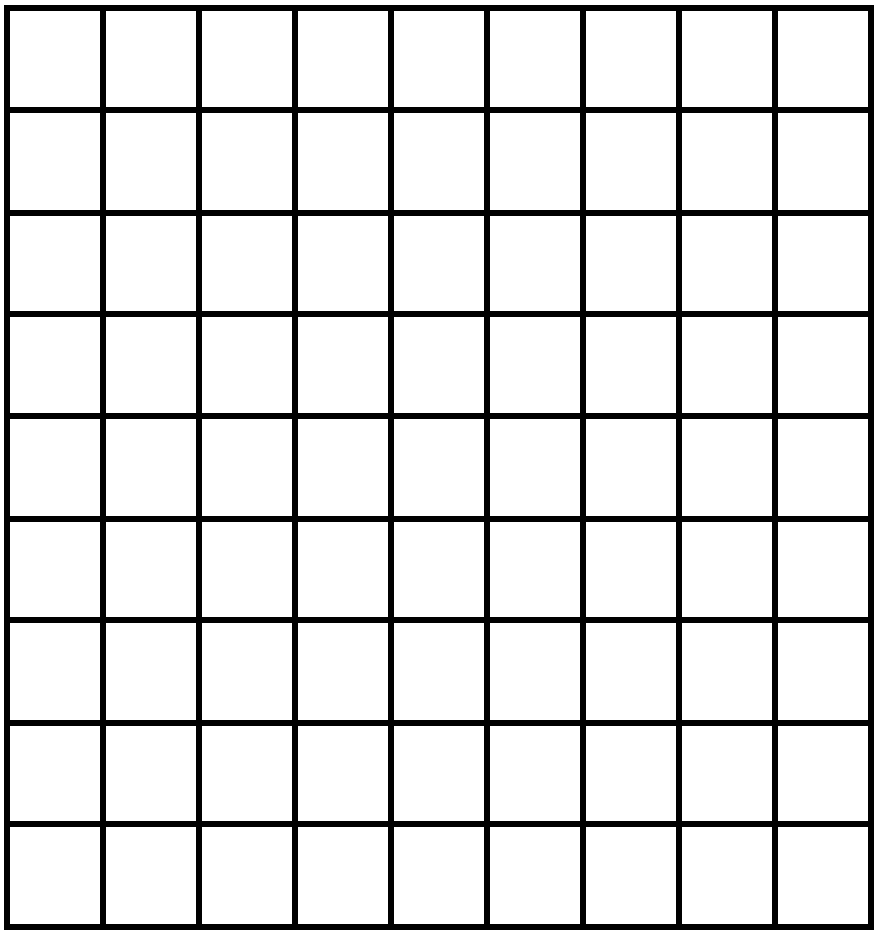
a 

b 

c 

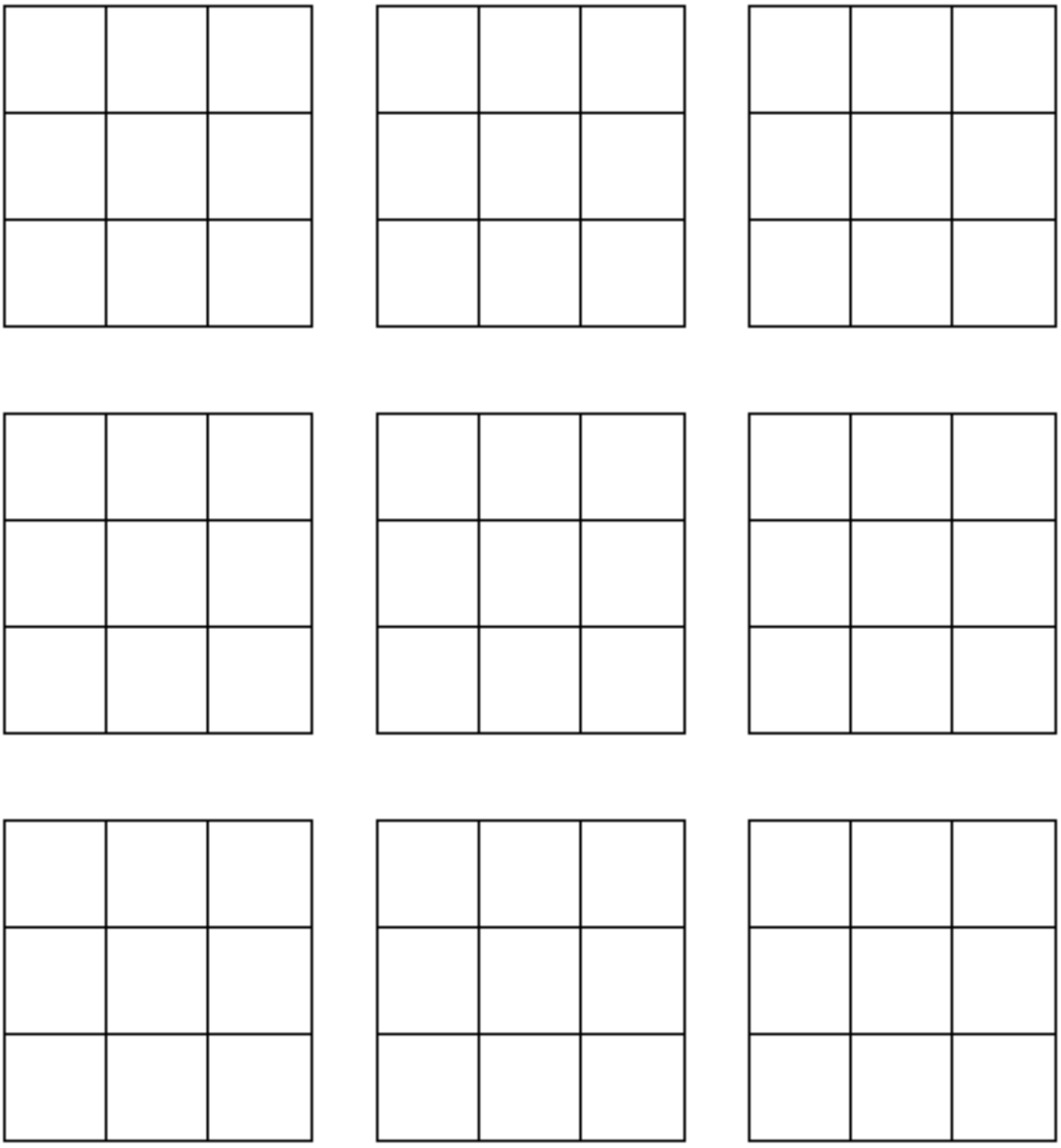
2) Describe how you went about the process of making these configurations. What techniques, strategies, or algorithms did you use to complete your tasks?

3) Design a template (or blueprint) for a mini-mosaic using only white, yellow, green, blue, red, and orange to design a picture or pattern. Each individual square may consist of only one color.



Building a Mini-mosaic

Take your picture/design from the previous page and translate it onto these templates that represent faces of 9 different Rubik's Cubes.



Cut out your 9 mini-templates. Hand a mini-template and a Rubik's Cube to eight different students. The nine of you will each solve a particular portion of the mosaic. Then collect all nine cubes back up and place them together to display your mini-mosaic.
Take a picture, and then let the next student distribute the Rubik's Cubes and their mini-templates.

Designing a Rubik's Mosaic using Gimp

You are going to learn how to turn a picture into a Rubik's Cube mosaic using the program GIMP 2 to do photo editing. The steps below will have two components: objective (what you want to happen) and task (how you are going to do it).

1) Objective: Get a picture to turn into a mosaic.
   Task: Take a picture, or find one online, and download it to the desktop of your computer.

2) Objective: Get the picture into the GIMP 2 program.
   Task: Open the program GIMP 2 and upload the picture by going to FILE → OPEN. Then select the picture from the desktop.

3) Objective: Cut out the desired portion of the picture selected.
   Task: Crop the image by using the *rectangle select tool*, found on the left panel, to outline the desired portion of the picture. Then click IMAGE → CROP TO SELECT.

4) Objective: Reconfigure how many pixels are in the picture to align with the number of Rubik's Cubes there are to use for the mosaic.
   Task: Reformat the resolution by first going to IMAGE → SCALE IMAGE. With a calculator, recalculate a new Width by using the original width shown, the original height shown, and the number of Rubik's Cubes available.

$$new\ width = \sqrt{\frac{9 \cdot n \cdot w}{h}}$$

   Type the new width into the width textbox and press enter. *The height should auto correct when typing in the new width. Then click *scale*.

5) Objective: Get a better look at your picture by zooming in.
   Task: Zoom in by using the *zoom tool* found on the left panel.

6) Objective: You are only allowed to use 6 colors, so you are going to reduce the number of colors used in the picture.
   Task: Change the # of colors by opening IMAGE → MODE → INDEXED, replacing 256 with 6, and then clicking *convert*.

7) Objective: You need to specify which 6 colors are to be used (red, orange, yellow, green, blue, white).
   Task: Change the 6 current colors to that of the Rubik's Cube by first opening WINDOWS → DOCKABLE DIALOGS → COLORMAP. To replace each color, click on one at a time and replace the HTML notation with one of the following:

Red: f60000	Green: 00d900
Orange: ff9c00	Blue: 3737b3
Yellow: ffff00	White: ffffff

   *Determine which colors will be switched with which before typing in the HTMLs.

8) Optional: transfer image to Microsoft Paint for more detailed editing. To do this, click on SELECT → ALL, then click **ctrl + c**. Open up Paint and paste in the image by clicking **ctrl + v**.

Designing a Rubik's Mosaic using Twist the Web

Using Gimp 2, we were able to walk through how a picture is transformed into a template for a Rubik's Cube mosaic. Now we will use a web-based program that might be seen as a quicker method.

1) Take or find a picture, and download it onto your computer's desktop.

2) Open the picture in Microsoft Paint to crop it. Leave only the rectangular portion of the picture desired for the mosaic. *Make sure to eliminate any white border around your picture, if there is any.

3) Resave it to your desktop.

4) In Google Chrome, go to www.mosaic.twisttheweb.com.

5) Drag your picture from the desktop into the dotted box on the website.

6) Enter the number of Rubik's Cubes that you have available for your mosaic. Then click on the right arrow

7) Optional: On this next page, you can alter the threshold of the colors by moving the slider. To move past this, click the right arrow.

8) On the "Assembly Guide" page, I recommend selecting *Blocks of 3x3 cubes*. Even though this will use more paper, it is better for Mosaic Builders who are less experienced. Then click the right arrow.

9) Finally, print or save the mosaic template.