In this lesson, students will use Rubik’s® Mini cubes to explore patterns using colors and math rules. This lesson might also serve as an introduction to using a Rubik’s Mini with early elementary students.

**Common Core Standards:**
Grades Kindergarten, First, Second – Mathematical Practices.

**Focus:**
1) Make sense of problems and persevere in solving them.
2) Reason abstractly and quantitatively.
6) Attend to precision.
8) Look for and express regularity in repeated reasoning.

**Additional Standards for Consideration:**
**Kindergarten:** Geometry. Identify and describe shapes.
CCSS.MATH.CONTENT.K.G.A.3
Identify shapes as two-dimensional (lying in a plane, "flat") or three-dimensional ("solid").

**First Grade:** Geometry. Reason with shapes and their attributes.
CCSS.MATH.CONTENT.1.G.A.1
Distinguish between defining attributes (e.g., triangles are closed and three-sided) versus non-defining attributes (e.g., color, orientation, overall size); build and draw shapes to possess defining attributes.

**Second Grade:** Geometry. Reason with shapes and their attributes.
CCSS.MATH.CONTENT.2.G.A.1
Recognize and draw shapes having specified attributes, such as a given number of angles or a given number of equal faces. Identify triangles, quadrilaterals, pentagons, hexagons, and cubes.

**Objectives:**
Students will explore repeating patterns with blocks and color. Students will use a math rule in order to produce a pattern and a pattern to produce a math rule.

**Materials:**
- Examples and manipulatives that model patterns (ex. colored gram cubes, pictures of patterns, etc.)
- Rubik’s Mini cubes (preferably a class set (one per child) or one Rubik’s Mini per partner set
- pencils
- crayons
- grid paper (teacher choice of size - differentiate)

www.YouCanDoTheCube.com

©1974 Rubik’s® Used under license Rubik’s Brand Ltd. All rights reserved.
STEM.org™ is a trademark of Initiative Science, LLC and is used with permission
Background

Knowledge:

• Explain that students will be using a Rubik’s Mini to help them understand patterns.
• Show a Rubik’s Mini to the students and demonstrate how the faces can be turned to change the colors on each face.

Procedure:

Before class:

Safety: Clean all Rubik’s Minis with sanitizing wipes.

Management:

- Student group size: 2-4
- Organize Rubik’s Minis centrally for dispersal to students.

Younger students might start this activity with all cubes arranged the same way with at least one face of the cube with two colors, side by side. Example:

```
<p>| |</p>
<table>
<thead>
<tr>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>
  or
```

With students:

1. Hook: Introduce and discuss patterns by providing an non-Rubik’s Cube example (teacher choice). Provide examples of designs that are not patterns and patterns that may or may not be a design. Ask students to identify examples as a pattern or non-pattern and explain why.
2. Identify any patterns in the classroom (bricks on wall, floor, bulletin board trim, etc.)
3. Introduce patterns with a Rubik’s Mini. Model how cubes can be turned to change the colors on each face. Discuss respect for materials and expectations – examples: no spinning, turning too hard, hold with both hands, etc.
4. Give each student a Rubik’s Mini. With younger students, ask them to identify a face of their Rubik’s Mini that has 2 colors side by side (show example of prepared cube and explain that they shouldn’t turn any faces until teacher directs). Older students may be asked to turn the cube until there are two colors (side by side) on one face (teacher models).
5. Using four or more cubes, all with the same two colors on a face, produce a pattern by arranging the Rubik’s Minis in a line on the table or desk.

Examples: (Six Rubik’s Minis)
Extensions

Students/groups raise hands when their pattern is complete (teacher check). Reteach and extend as necessary until all groups are teacher checked and successful with at least one pattern. Group extension ideas while teacher checks other groups:
- Use the same two colors to produce a pattern in a different way.
- Proceed to Step 6.

6. Using two more colors in the same way (colors side by side), create another pattern. Afterward, draw your pattern on your grid paper with your pencil and coloring materials.

Extension 1: On your paper, label your pattern with letters or a math rule.

Example with alphabet letters:

```
A B A B A B A B A B A B
```

Example with letters for the colors represented:

```
R Y R Y R Y R Y R Y R Y
```

Extension 2: Challenge your students to create more complex patterns using two or more colors, additional cubes, and in different arrays. Challenge students to write the pattern with letters. Example:

```

Challenge: How could you write a math rule for this pattern?
```

Extension 3: Pattern Race. Using a pair of dice (associate each number on the face of the dice with a cube color). Roll the dice for two colors. Be the first group to produce a pattern using those colors.

Extension 4: Students take turns writing patterns with a math rule (alphabet letters or letters representing color), and try reproducing with the Rubik’s Minis. Teacher writes color/letter pattern on board and students try to reproduce with cubes.
Extension 5: Creating, Describing, and Analyzing Patterns Interactive from National Council of Teachers of Mathematics:

- [http://illuminations.nctm.org/Activity.aspx?id=6386](http://illuminations.nctm.org/Activity.aspx?id=6386)

Extension 6 / Sponge: Ask students to turn the cube in order to create one or more sides that have all the same color. Challenge students to see how many colors they can solve for (not at the same time – complete solve).

Notes to Teacher:

- Provide teacher prompts/questions for related Geometry standards during the lesson (see Common Core Standards above).
  - Example: What shape is each side of the Rubik’s Cube? (square). How many sides (faces) does a Rubik’s Cube have? (6) What geometric shape is a Rubik’s “Cube”? (cube). How many comers does a cube have? (8). How many colors are represented on the Rubik’s Cube? (6) Name them. etc.

- Professional Reading:

This lesson was created by Colby Counter – Matt Elementary STEM Teacher in Cumming, GA