Patterns
Introduction

Before introducing the word "pattern" try this activity with your students.

Have children sit in a circle and explain that you are going to try a simple activity by going around the circle clockwise. Choose one student to begin and have that student clap once, the child to their left will then clap twice, continue to move clockwise around the circle and have the third student clap once, the student to their left clap twice. Continue this pattern all the way around the circle until all students have had a turn.

Now introduce the word pattern to the students, explaining that the clapping activity was a repeating pattern. The one clap, two clap, one clap, two-clap pattern was repeated around the circle.

Explain to the students that a repeating pattern is the something that occurs over and over again. In the clapping activity, we clapped a one, two pattern around the circle. Can anyone think of any other patterns that are happening in the classroom? Students may have answers, such as the tile floor, or an Aa, Bb, Cc alphabet sign.

Have students continue the hands-on sound clapping activity by working with a partner or in small groups, each person taking a turn creating a clapping pattern for the other students to repeat.

Pattern Hunt
Grades K-2

Whether at school, at home, or outside playing, students will begin to recognize a variety of patterns outside the doors of their classroom.

Objectives:
•Students will recognize a visual, sound or texture repeating pattern.
•Students will describe a pattern to others.

Standards Addressed:
•Describe how most things are made up of multiple parts and explain that things may not work if some parts are missing. (NH S:SPS:32:3.4)
•Identify and describe patterns and relationships in observed objects and events. (NH SLSPS1:2:4.2)

Materials:
Paper & pencils

Procedure:
Give students five minutes to observe any patterns they can see, hear or touch from sitting at their desk. Have students write down their observations.
After five minutes, explain to the children that they are going to try to have the rest of the class guess a pattern that they observed by only giving everyone one clue at a time. The teacher should begin by describing a pattern he/she saw in the classroom. For example if it is a pattern on the floor, begin by sharing the color pattern and give students a couple of guesses, if nobody guessed the pattern you are describing, give another clue such as the shape. Once your pattern has been guessed, have one student begin to describe a pattern he/she has discovered following the same procedure of giving one clue at a time and time for students to guess.

Once everyone has had a turn, send students off into the school in groups to record any patterns, they hear, feel or see. Once all students have returned, play the same guessing game. You will find that some students will choose to use different descriptive words when describing the same pattern!

Extensions:
Students can record patterns they witness on the playground or even at home.

Get musical! Do you or any of your students play a musical instrument? Invite them to play for the class, while everyone listens for repeating patterns in the song. Another easy alternative to live music is to listen to recordings of music that has clear repeating patterns. (Drum beat patterns are particularly fun for this one!) Have students listen and tap their fingers to the repeating beat on the floor or table tops.

Color & Shape Patterns
Grades K-5
Creating a necklace, bracelet or string with colored pasta will give students an opportunity to create patterns with a hands-on activity.

Objectives:
•Students will choose to create a color or shape pattern using dyed pasta.
•Students will be able to verbally describe their pattern to another student or teacher.
•Students will string together a strand of pasta with a repeating pattern in the pasta's shape or color.
•Students will use their fine motor skills to string pasta.

Standards Addressed:
•Show how most things are made of parts. (NH S:SPS2:2:2.1)
•Identify shape and use of objects. (NH S:SPS2:s:5.1)

Materials:
Quart sized zip lock bags
Food Coloring
Rubbing Alcohol
String
Masking Tape
Pipe Cleaners
Newspaper
A variety of uncooked pasta with large holes, suitable for stringing, such as penne, wheels, or ditalina

Dying Pasta:
First you will need to dye the pasta keeping in mind it will need to dry for 12-24 hours prior to using it with the children.
Spread newspaper out on the flat surface. Fill each zip lock bag 1/2 full with uncooked pasta. Then pour about 2 tablespoons of rubbing alcohol in each bag along with 15-25 drops of food coloring (more if you would like a darker shade). Seal the bag and gently shake and massage the pasta to distribute the food coloring and rubbing alcohol.
Once the color is evenly distributed, pour the pasta out on the newspaper to dry. Make sure that the excess coloring liquid doesn't seep through the newspaper onto the surface below.
It usually takes 12 hours for the pasta to dry completely.

Procedure:
Students will each need either a piece of string or a pipecleaner (for bracelets) to begin. If using string or yarn, wrap a piece of masking tape around one end of the string to create a needle like stiff end, the other end of the string should be taped to the students desk so that the pasta doesn't slide off the end.

Begin the activity by reviewing what a repeating pattern is, start by holding up a red piece of pasta, then a blue piece, then a red piece, ask the children, "what color comes next?" Depending on the students' familiarity with patterns, you may start with simple or more complex patterns.

Children will then have the opportunity to create their own color pattern using the dyed pasta. If you've dyed different types of pasta, some students may choose to create a shape pattern or possibly a color and shape pattern.

Extensions:
•Using a piece of string 25 feet long, give each student the opportunity to create a 10 inch patterned section. Once all children have had the opportunity to add their pattern to the string, hang the string around the room for everyone to see.
•Students can begin to expand their patterning skills by stringing three or four step patterns.

Adaptations:
For students who are visually impaired, be sure to use pasta with more than one shape so that they have the opportunity to create a shape pattern.

Patterns In Weaving
Grades 2-5

Introduction:
Using a hands-on approach, children can create a woven pattern with paper to create a placemat.

Objectives:
•Students will create a woven placemat by following a simple two step pattern
•Students will be able to explain their two step (under, over) pattern.

Standards Addressed:
•Follow a simple step-by-step procedure. (NH S:SPS1:2:3:.2)
•Explain that something may not work if some of its parts are missing. (NH S:SPS2:2:2:.3)

Materials
Legal sized construction paper in several colors
Clear tape

Procedures:
Prepare one sheet of construction paper per child beforehand by holding paper the "tall way"(portrait) cut one inch strips up from the bottom stopping one inch from the top of the paper. Cut enough 8.5in. x 11in. strips so that each child has ten strips of paper that are a different color than their tall weaving sheet.

Begin the lesson by reviewing what a two step repeating pattern is, for example a, b, a, b, a, b, etc. Come up with four or five different two step repeating pattern examples and have the students continue your pattern after you have stopped; you can do this by using colors, names, shapes or letters. Students can come up with their own two step patterns and begin to "quiz' the child sitting next to them.

Once everyone has an understanding of what a repeating pattern is, pass out one long piece of the cut construction paper per child. Tape a piece of the construction paper to the whiteboard so that all children are able to see it, tape the paper lengthwise with the solid one inch strip you left uncut is at the top. Have children place their paper this way on their desk with the solid uncut edge farthest from them.

Explain to the children that you are gong to be weaving a work of art or a placemat using repeating patterns. Instead of "a, b," you will be repeating "over" and "under" to weave. Give each child ten one-inch strips of construction paper, all in the same color.

Starting closest to the top, begin by going under the fist flap, over the second, under the third, over the fourth, under the fifth, over the sixth, under the seventh and over the eighth. Gently snug the strip up as close to the top as it will go. Use a piece of tape to hold the strip in place. For the second strip, begin on the same side but with the beginning wit the opposite direction, over the first, under the second, over the third, etc. Continue to slide each strip up close to the previous strips to keep the space as tightly woven as possible.

Extensions:

- Have children experiment in their weaving style by going under two, over two or under two, over one.
- Instead of weaving with one color of construction paper, give children two colors to create a repeating color pattern as well.
- Children can also experiment by using materials other than paper to weave their pattern, such as yarn, ribbon, wrapping paper or items from nature such as long grass or seaweed.

Mosaic Patterns
Grades 2-5

Introduction:

What is a mosaic? A mosaic is a design that can be made using small shaped materials. Mosaics can be made of materials such as stone, glass, tile, paper and fabric. You might see a mosaic pattern created on a picture, vase, quilt, floor tile, rug or wallpaper. Although you may consider creating a mosaic to be an "art" project, making a mosaic design like the ones we're making today uses math and problem-solving skills as well. For our mosaics, we will be using patterns and symmetry, rotation, sequencing, and for older students, challenges with fractions and area, to complete our designs.

Objectives:

- Students will use a variety of colored squares to plan and design a mosaic pattern.
- Students will recognize how a missing piece disrupts their overall design.

Standards Addressed:

- Sort and classify object materials and events based on one or more attributes; and explain the methods used for sorting. (NH S:SPS 1:2:2:1.5)
- Suggest a plan and describe a sequence of events for conducting an exploration. (NH S:SPS 1:2:2.2)

Materials:

small colored wooden and paper mosaic squares
approximately 4" x 4" square foam squares (or cardboard)
glue (and scissors if you would like to cut paper squares into triangles)
paper grid to lay out your design before gluing it on foam & colored pencils
images of mosaic patterns - http://mosaicpatternsonline.com/

Procedure:
1. Begin by gathering one foam square on which to create your mosaic, as well as a graph paper square to map out your design. (Place small piles of wooden and paper mosaic squares in the middle of student work areas, as well as glue, to share.)
2. Before you begin, first plan your design by laying out the mosaic pieces on a piece of graph paper that is the same size as the foam. Trace around the square of graph paper and cut to size if it is larger than the foam square. When creating a design, think about making a pattern on your square, such as one that repeats, one that is symmetrical, one that has rotational symmetry (looks the same any way that you turn the square). The pattern can be made using wooden pieces, paper pieces, or both. The paper squares can be cut into triangles, if you wish to add a new shape to your mosaic design.
3. Once the design is complete on graph paper, you can transfer your mosaic onto the foam square, one piece at a time, gluing down as you go.
4. For older students looking for a challenge, you can create a mosaic using one or more of the following guidelines: create a pattern that has two lines of symmetry, use equal numbers of four different colors to make a design and then using one square as a unit of measure, and you can calculate the area of your finished mosaic.

Extensions:
• Use your piece of graph paper to draw a second mosaic pattern that is different than the first one you made using colored pencils.

Exploring Symmetry

Grades 2-5

Is your face symmetrical? If you were to draw a straight line down the middle of your face, will both sides look the same? How about your name or some of the letters in your name? Symmetry means balance. Line symmetry (reflective symmetry) is when you can draw a line down or across the middle of something and both sides are identical.

Objectives:
• Students will be able to recognize a symmetrical letter or shape.
• Students will be able to draw a line of symmetry across a shape.

Standards Addressed:
• Observe hat when parts are put together, they can do things that they couldn't do by themselves. (NH S:SPS2:2:2.2)
• Use geometric figures, number sequences, graphs, diagrams, and pictures as scientific models. (NH S:SPS2:4:3.2)

Materials:
Each student will need a small (3inx3in) mirror
Paper
Pencils

Procedure:
Introduce the idea of reflective symmetry by standing in front of the class and covering one side of your face with a sheet of paper, making sure that the edge of the paper lays down the middle of your nose. Ask students if your face is the same (or symmetrical) on both sides. Explain to students that the line of symmetry needs to split the object or item in half, it must always run fully across or down the middle of an object. Switch the paper to then cover the opposite half of your face. Ask students if they can see objects in the rooms that are symmetrical.

Write the letters A, C, F, M, B (in capitals) on the whiteboard. Ask students if any of these letters are symmetrical. Using a ruler point out the lines of symmetry to students, for example the line of symmetry for the A is down the middle but the line of symmetry for the C is across the middle.

Have students write the alphabet on a piece of paper using only capital letters. Pass out mirrors to each student and show them how to place the mirror along the line of symmetry so that they are looking at the reflection and half of the letter on the paper. Let children discover on their own which letters are symmetrical.

After everyone has found letters with lines of symmetry. Challenge the students to write symmetrical words. A word you can use as an example would be ICEBOX, with the line of symmetry across the middle.

Extensions:

- Students can write symmetrical sentences.
- Students who aren't comfortable writing letters, can practice finding lines of symmetry in objects around the room or shapes they draw.

Butterfly Symmetry

Grades 2-5

After exploring lines of symmetry, students can get creative by creating a colorful, symmetrical butterfly.

Objectives:

- Students will design their own butterfly using liquid watercolors.
- Students will explore creating their own colors with primary colors.

Standards Addressed:

- Select tools and procedures, in a purposeful way, to explore objects and materials. (NH S:SPS1:2:2.1)
- Discover that when a scientific investigation is done the way it was done before, we expect to get a very similar result. (NH S:SPS2:2:1.2)

Materials:

White Cup Coffee filters (not cone shape)
Liquid water colors
Eye droppers
Markers
Wooden clothespins

Procedure:

Show students photographs of butterflies. www.natureinart.com/butterfly.htm
Students can use their mirrors from the Exploring Symmetry activity to find their line of symmetry. Discuss how a butterfly's wings are symmetrical to eachother. Distribute coffee filters, one filter per child. Have children flatten their coffee filters and smooth out the creases, then fold filter in half to create a half circle. Using the eye droppers and liquid watercolors, place one drop at a time onto the coffee filter, making sure that both sides of the filter are touching so that the paint leaks from the top layer through to the bottom.

Give children time to fully cover the entire half of the coffee filter with watercolors. Students will discover that the colors will begin to blend together if too much liquid watercolor is added. Once students are done, have them carefully open their filter to discover that their coffee filter now has two symmetrical designs.
Once the paint is dry, fold the coffee filter along the line of symmetry, similar to how you would fold a paper fan. Place the wooden clothespin in the middle and gently open both sides of the filter to create the butterfly wings. Students can now color their clothespin using markers to decorate their butterfly's body.

Extensions:
Instead of folding the coffee filter in half, leave the coffee filter open and challenge students to create a reflective design using the liquid watercolors.

Adaptations:
Instead of using liquid watercolors for students who are visually impaired. Use objects with texture and a certain shape such as pasta to glue on either side of a cardboard cutout of a butterfly.

Rotational Symmetry
Grades 3-5
In large groups, students can learn to follow directions and recognize rotational symmetry.

Objectives:
- Students will follow simple directions.
- Students will visually and physically recognize reflective and rotational symmetry.

Standards Addressed:
- Provide examples that demonstrate that something may not work well (or at all) if a part of it is missing, broken, worn out, mismatched, or misconnected. (NH S:SPS2:4:2.2)
- Demonstrate that some features of things may stay the same even when other features change (e.g., some patterns look the same when they are shifted over, turned, reflected or seen from different directions). (NH S:SPS2:4:4.3)

Materials: a large empty space such as playground or gymnasium.

Procedure:
Have children form two lines standing directly across from their partner. Begin by reviewing reflective symmetry and have children "shadow" the person across from them. Remind students that the reflective line of symmetry is an imaginary line between them and their partner and if we were to "fold" the line in half then their bodies should line up. Give each line a name, for example line 1 and line 2. Give directions to each line at a time and ask that the opposite line "shadow" or "mirror" what their partner is doing. Have line 1 raise their right hand, Line 2 should raise their left hand. Ask line two to put their right hand on their hip, line 1 should put their left hand on their hip. Have students follow this exercise for a few minutes, giving each child a chance to give a command.

Separate the two lines and form a circle. Explain to students that with rotational symmetry, no matter what angle you are looking at the circle, all images should appear the same. Ask students to raise their hands above their head. Looking around the circle all bodies should be in positioned in the same direction. Continue this exercise on rotational symmetry by using a variety of body movements. For example, have students put their right food towards the center of the circle and their left foot behind them.

Extensions:
Follow up with this activity by having students create their own mosaic patterns or pizzas using construction paper cut outs.