Brick by Brick 1 - Project 1
Units 1 and 2
Color Mixing with Water and Light

Objectives and Learning Outcomes

- Make a walking water rainbow.
- Dip paper strips in colored water to get secondary colors.
- Mix black and white paint with primary colors.
- Mix colored light.
- Observe what happens when mixing colored water.
- Observe what happens when adding black and white to primary colors.
- Observe what happens when mixing colored light.
- Explain the results of mixing primary colors with water.
- Explain the results of mixing primary colors with light.
- Contrast what happens when mixing colored water and colored light.
- Observe capillary action as colored water moves upward through paper towels.

Materials Needed

- 6 clear jars or medium-sized, clear drinking glasses.
- Food coloring and/or washable liquid watercolors. (Note: food coloring may stain clothes, and so washable watercolors may be better for the activity involving dipping paper strips. Food coloring, however, may work better than typical school paints in the walking water rainbow activity, and because students don't do a lot of hands-on work in this one, it's likely a safe choice for that part.)
- Paper towels, the thick, absorbent kind.
- Water.
- 3 plastic cups or containers (deep enough for dipping) per pair.
- Heavy paper (cardstock) cut into strips (approximately 12 cm long and 4 cm wide, between 5-10 strips per student)
- Crayons or colored pencils.
- Paint brushes and surface to mix on, such as a polystyrene tray or a plastic plate.
- Heavy paper (cardstock) to paint on-one or two sheets per student.
- Scissors and glue sticks (optional).
- 3 flashlights.
- Small piece of translucent cellophane paper in green, red, and blue.
- Rubber bands or tape.
- Dice-one die per pair or group of students.

Target Language

Primary colors: *red, blue, yellow.*
Secondary colors: *purple, green, orange.*
Other colors: *brown, indigo, violet, black, white, gray, pink, light blue.*

Simple sentences: "*Yellow and blue make green*" etc.
Actions: *mix, dip, drip, walk, swish*.
Names of materials: *water, light, paint, paper, paper towels.*
Other: *light, dark.*

Timeline for the Project

Number of lessons: 5
Warm up: Lesson 1 - Review colors and sequence of rainbow (5-10 minutes).
Development: Lesson 1 - Set up materials for a walking water rainbow (15-20 minutes); Lesson 2 - Do an experiment dipping paper strips into colored water (15-25 minutes), assess the experiment in a worksheet and speaking drill (15-25 minutes), play a game (5-10 minutes); Lesson 3 - Assess the walking water rainbow (5-10 minutes), mix black and white paint with primary colors (20-25 minutes); Lesson 4 - Make something out of colored paper strips (15-60 minutes); Lesson 5 - Do an experiment with colored light (10-20 minutes), assess the experiment in a worksheet and speaking drill (15-25 minutes), play a game (5-10 minutes).
Review/Conclusion: Lesson 5 - Discuss the differences between mixing colored water and colored light (5-10 minutes).
Assessment: Students will be able to say which primary colors combine together to form the secondary colors, for both colored water and for colored light.

Lesson 1

To warm up, start by pointing to objects of different colors in the classroom, asking “What color is this?” Have the students review all the colors they’ve learned. Ask students to recite the colors of the rainbow, in order. Optional: Give each student a card or an object with a color, and ask them to form a line according to the colors of the rainbow. They must figure out the sequence among themselves. Check by walking through the line, and having students say the colors in order: *red*, *orange*, *yellow*, *green*, *blue*, (indigo[1]), *violet*.

Remind students of the activity they did in the book, mixing secondary colors. Ask them if they remember the primary colors—the three colors that can be used to mix other colors (red, yellow, blue). Show them the three jars filled with water, and ask students what’s inside, teaching the word *water*. Invite students, one at a time, to put some drops of food coloring in a jar. It’s good to get a deep color, but yellow pigment might start to look orange when concentrated too much. 10-15 drops would be a good amount of color to aim for.

Provide three more jars, and keep them empty. Put all the jars in a circle, following this sequence: red – empty jar – yellow – empty jar – blue – empty jar – back to red. Tell students they are going to make water “walk” to make a rainbow, demonstrating the action to walk. Ask them which colors are missing from the rainbow (orange, green, violet/purple).

Provide some paper towels, making sure each piece is long enough so that when rolled into a rope-like form, it can rest half in one jar, submerged in the colored water, and half in the empty jar. Ask students “What’s this?” and teach the word *paper towel*. Show students how to twist and roll the paper towels so they look like a rope, and place them half in one jar, half in another.

[1]Note: indigo is optional as it is not necessarily a color that we will be working with in these activities, and it can be hard to find in true form.

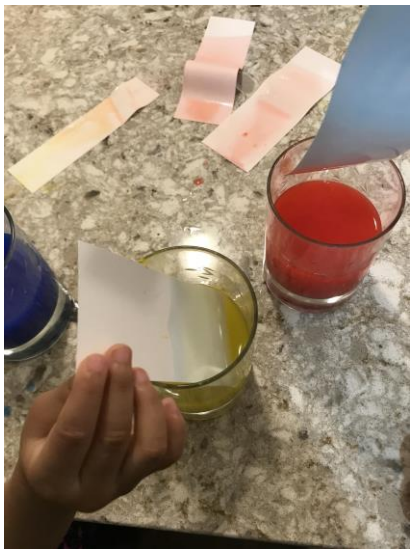
Ask students to predict what they think will happen—how will a rainbow form? How will the colored water "walk?" Tell them they will have to wait a day or two to find out what happens.

Lesson 2

Lesson 2 can directly follow Lesson 1 in the same class period, or can be done on a different day. Ask students if they remember how to mix the secondary colors (orange, green, and violet/purple). They've already done this in the book. Remind them of their predictions from setting up the walking water rainbow, if necessary.

Provide each pair with three plastic containers, filled a little more than halfway with water, and guide students in putting drops of color in them as before. (For this part, washable liquid watercolors are recommended, as the experiment will likely get messy.)

Tell students they will do an experiment. Ask "What's this?" and show them a paper strip. Teach the word *paper*. Demonstrate dipping a strip of paper in one color, covering more than half of the strip, and teach the verb *dip*. Show how to gently shake it over the cup allowing excess water to fall, teaching them the expression "Drip, drip!" After dipping one side, students will turn the paper strip upside down and dip it in another color. Then they will watch to find out what color forms in the middle as the colors touch each other.



Model a simple sentence based on the students' results, such as: "Yellow and red make orange!" Encourage students to share their results with each other in English. There will be a more controlled activity later, so it's OK if students get caught up in the excitement of the activity and forget to say the words in English. Mingle and model English sentences, prompting students to say the results aloud in English whenever possible.

Children will likely try mixing all three colors eventually. Ask them what color they get. (It will probably be a muddy brown, but accept any other color names that match their perceptions.)

Depending on the pigment concentration of the watercolors, the results from the dipping experiment may be lighter, so much so that red looks like pink. You can tell students that the white of the paper also combines with the paint to make colors.

Students can keep experimenting until they've used all the strips assigned to them. When finished, lay the strips out to dry. Have students clean up the work area, and give them the **worksheet 1**. Explain the directions, to color in the results of their experiments.

When students are finished, check comprehension of the color mixing results, and elicit sentences in English, such as the following:
Teacher: "Yellow and blue."
Students: Yellow and blue make green!"
Teacher: "Yellow and red."
Students: "Yellow and red make orange."
Teacher: "Red and blue."
Students: "Red and blue make purple."
Keep mixing it up, saying another color first.
Teacher: "Blue and yellow."
Students: "Blue and yellow make green."

Continue until students can say all combinations of color mixing without hesitation. Instruct students how to play the game in pairs. One student rolls the die and says the colors on the worksheet corresponding to the number. The other student says the same kind of sentence that was drilled together with the teacher: "____ and ____ make ____."

End this lesson by inviting students to observe the walking water rainbow. Some color may have risen up the

paper towels, but it's likely that no color mixing will have taken place yet. Ask for students predictions again, and tell them they will have to wait another day or two.

Lesson 3

After 48 hours or less, the colored water should have flowed through the paper towel into the empty jars, mixing together to form orange, green, and purple. Discuss the results with the students, reviewing the sentences they practiced last time. Help students understand that the water "walked" up the paper towel the same way that water moves from the ground, upward into the leaves of a plant.

Review the primary colors (red, yellow, blue) and the secondary colors (green, orange, purple/violet) with the students. Ask students to name other colors they learned that are missing. (Black, white, gray, brown.) Ask them how to mix brown (By mixing all the primary colors). Ask them if they know what happens when black and white are mixed. Tell them they are going to find out.

Provide everyone with a paint brush, paper, plastic water container, and something to use as a mixing palette, like a plastic plate or a polystyrene tray. Give each student some black and white paint and encourage them to mix a little of each color together, not using all of the black or white. Ask them what they got (gray). Encourage them to explain this in a sentence "Black and white make gray!" Ask them what happens when they add more white paint to the mixture. (It becomes light gray.) Ask them what happens when they add more black paint (It becomes dark gray.). Teach the words *light* and *dark*, and explain that they can describe colors.

Before providing the primary colors (red, yellow, and blue) on their palettes, guide the students in how to clean off their brushes between colors. Show them how to swish the brush in the water, saying "Swish, swish!" and then drip it on the side of the cup to remove excess water, saying "Drip, drip!" Encourage students to say these expressions as they work.

Students will now mix the primary colors with black and white and discover what different colors can be made. Have them paint these new colors on the paper, cleaning the brush each time. Help them name the new colors. Some important ones to notice: Red and white make pink. Blue and white make light blue. Blue and black make dark blue. Yellow and black make dark green (or perhaps dark yellow). All the colors mixed together make brown, either a light brown, or a dark brown, depending on how much black or white is added. Students may prefer to do most of the mixing on their palettes, and may start painting their own designs with the colors they've mixed. That's what artists do! If you decide to use all the painted papers (minus any personalized paintings) in a mosaic activity (see **Option 3 for Lesson 4**), have students clean off their palettes by mixing together all the colors they have left and covering an entire page with the result. You may want to give them a paper towel or a sponge to paint with for this part.

End the activity by asking students to name all the different colors that were mixed and ask them to remember how they were made by asking questions such as, "How do you make brown/gray/pink, etc.?" Because there are a lot of variables in this kind of color mixing, it's OK if you don't cover in a specific formula all the colors that were mixed. The important ones to notice, though, are gray, pink, and perhaps light blue/dark blue, etc.

Lesson 4

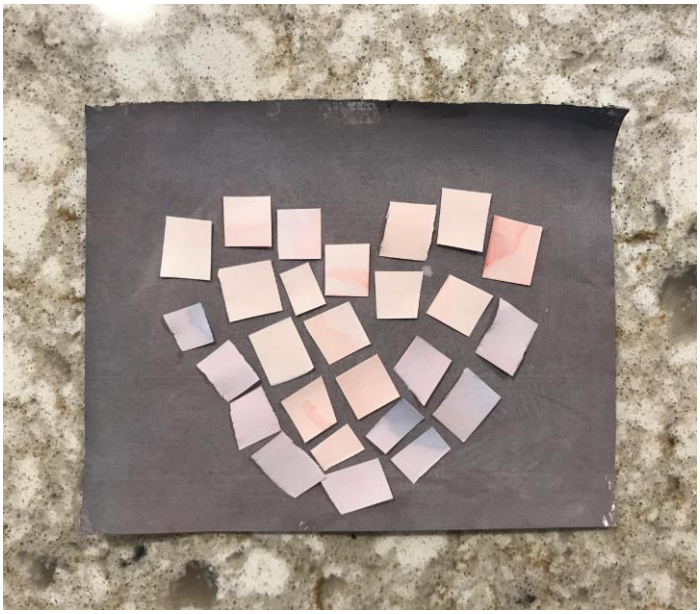
In this lesson, students will make something out of the papers they colored and painted, after they have dried. Depending on how much time is available, there are three options to choose from:

Option 1 (10-20 minutes): Make a large paper chain from the strips colored in **Lesson 2**. Curve one strip and

staple it to make a circle, then add another strip through the circle, stapling it, and add to the chain one piece at a time. Have students bring the strips and loop them through the chain. Review the color sentences with the students as you make the chain together, observing the colors that were mixed. The chain can decorate the classroom.

Option 2 (15-25 minutes): An alternative way to use the colored strips is to make bookmarks that can later be given as gifts. Students can draw on top of them with markers or crayons, decorating them as they wish.

Option 3 (50-60 minutes): Make a mosaic. Have students cut paper strips into squares of about a centimeter, and make sure they sort them according to color. Provide little plates or trays to collect the small pieces, and have students say the name of the colors as they place them. You may include some of the mixed colors from Lesson 3 as well; the variation in tone will look interesting. If students covered a sheet of paper with the mixed gray tones, this will make a great background. Draw a simple shape onto that gray painted paper and demonstrate how to choose pieces of similar (or different) colors and glue them together onto that shape. An easy subject for students to create would be a rainbow, but they may choose any simple shape like a heart, fruit, or even a face. This activity may require more than one class period if students get into detailed designs. To save time, you could pre-cut and sort the paper, and give them a smaller background paper to begin with.



Lesson 5

Take any leftover pieces of colored paper from the previous lessons and hold two of them together. Ask “What color is it?” for both of them, and then ask students to say what color they make together, for example: “Red and white make pink.” Review the primary (red, yellow, blue) and secondary (green, purple, orange) colors, and remind students that white and black are special colors.

Tell students that they are going to make secondary colors with light. Ask them if they think the color mixing will be the same or different. Provide three flashlights covered in colored cellophane, green, red, and blue, secured with rubber bands or masking tape. Tell students that these are the primary colors of light. Ask them what’s different from the primary colors they worked with before. (This group includes green in place of yellow.)

Turn off the lights and find a dark place for the activity. Call the names of two colors, and students holding those

two flashlights will shine them onto the same spot on the wall. Help the group notice the new color that forms. Prompt similar sentences as before, reviewing the words *pink* and *light blue* as they appear. Students will make statements such as: “Red and green make yellow. Green and blue make light blue. Blue and red make pink.” Drill as many times as needed until students say the combinations without hesitation. End by having students shine all three lights onto the same spot, and notice the color formed--white!

Have students go back to their places to complete the **worksheet 2**. As before, students will color in the circles describing what they saw. Also, as before, they will do the same game with dice, rolling and saying the two colors that make a third color.

Wrap up by asking students about the differences between mixing water and light. They should know now that the primary colors in paint (used with the water) are red, yellow, and blue, and should also be able to say what they mix to form, and also that the primary colors in light are red, green, and blue, and be able to say what they mix to form. They should know that all three primary colors in paint mix to form brown, and that all three primary colors in light mix to form white.

Summary of Color Mixing

Primary Paint Color		Primary Paint Color	=	Secondary Paint Color
Yellow	+	Blue		Green
Red		Yellow		Orange
Blue		Red		Purple

All the primary paint colors (yellow + red + blue) = brown

Other Paint Color		Other Paint Color	=	New Paint Color
Black		White		Gray
Red		White		Pink
Red		Black		Dark red
Blue	+	White	=	Light blue
Blue		Black		Dark blue
Yellow		White		Light yellow
Yellow		Black		Dark yellow or green

Primary Light Color		Primary Light Color	=	Secondary Light Color
Green	+	Blue	=	Light Blue
Red		Green		Yellow

Blue	Red	Pink

All the primary light colors (green + red + blue) = white

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