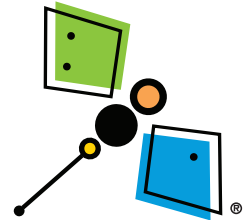


DragonflyTV: GPS Activity 15 Lighten Up!



Exploratorium
San Francisco, CA
exploratorium.edu



Light and Color

We're Peter, Emma, Aaron, Ixchel, and Kaitlyn, and we're in our school's science club. Our teacher gave us a special assignment. We need to come up with a colorful art display that doesn't use paints! We went to the most colorful place we know in San Francisco, a cool museum called the Exploratorium. Our question: How can we produce colorful art without using paint?

We saw lots of light and color exhibits at the Exploratorium, so we re-created some in our art exhibit. We used colored lamps to produce colored shadows by mixing light! We learned how to reflect light off a moving surface, like the Magic Wand exhibit. And we found out we could make rainbows of color with things like prisms and even CDs!

When we tried to make a purple shadow out of red and blue lamps, we didn't get the result we wanted. When we added a yellow lamp to the mix, then we made a purple shadow. That's wacky! We found that prisms and CDs both bend white light in a way that brings out the colors of the rainbow. We built a cool CD sculpture that looked awesome!



expl  **ratorium**[®]
the museum of science,
art and human perception



Icebreaker

Start seeing colors produced by a black and white image using Benham's Disk!



1 hour

DragonflyTV Skill: Observing

Guide your kids as they

- 1) Go to http://www.exploratorium.edu/snacks/benham_disc_graph.html and print the Benham's Disk pattern found there. Mount it on a cardboard backing with adhesive. If your printer doesn't make good solid blacks, fill in the black areas with a black marking pen. You can reduce or enlarge the pattern disk if you like.
- 2) Attach the mounted disk to a rotator.
- 3) Spin the disk under bright incandescent light or sunlight. (Fluorescent light will work, but causes a strobing effect that gives the disk a pulsating appearance and makes it harder to look at.) Notice the colored bands that appear on the disk. Look at the order the colors are in. What color do you see at the center? What about the next few bands?
- 4) Reverse the direction of rotation and compare the order of colors again, from the center of the disk to the rim.

▶ You'll need:

- posterboard or cardboard
- glue stick or other suitable adhesive
- pattern disk
- access to a copy machine
- a black marking pen
- a rotator, such as a portable electric drill

DFTV Science Helper

You can use a turntable, variable speed electric drill, hand drill, portable electric mixer, or electric screw driver. Attach the disk with adhesive Velcro, or if a drill with a chuck is used, a bolt can be used as a shaft, with two nuts to hold the disk. You can also reduce the size of the disk on a copy machine, then mount it on the flat upper surface of a suitable toy top, or you can devise your own spinner for the disk. Try spinning the mounted disk on a pencil point, or on a pushpin stuck into a pencil eraser.



For more great activities like this one from the Exploratorium, visit <http://www.exploratorium.edu/snacks/index.html>



Investigation Colored Shadows



2 hours

Guide your kids as they

- 1) Locate a darkened room.
- 2) Hang a white bed sheet to act as a screen.
- 3) Insert colored spotlights into the desk lamps, and plug them into a power strip.
- 4) Turn on one lamp only, aim it at the bed sheet from a distance of 6-8 feet, then stand in front of the lamp and notice the color of the shadow. Repeat using the other color lamps, one at a time.
- 5) Now select two lamps to turn on. Each lamp should be 6-8 feet from the screen, and the two lamps should be about 3 feet apart from each other. Stand in front of the lamps. Notice that there are two shadows. What colors are they? Repeat using other combinations of two lamps.
- 6) Now add a third lamp. Now there are three shadows. What colors of shadow do you see now? Experiment with other combinations of three lamps at a time.

▶ You'll need:

- colored spotlights, such as those available at a hardware or home improvement store. One each of red, green, blue, and yellow.
- desk lamps, one for each spotlight
- a power strip, to plug all the desk lamps into
- a white bed sheet to act as a screen, or a plain white wall
- a room that can be darkened

DFTV Science Helper

In this activity your kids will be mixing light, not mixing paint. The rules are a little bit different here. Invite your kids to discuss their experiences of mixing colors of paint, and then compare that to what they get from mixing colors of light. Challenge your kids to come up with a plan to make shadows of all colors. What does it take to make shadows of red, green, blue, yellow, orange, purple, or black? Is it possible to make a white shadow?



DFTV Kids Synthesize Data and Analysis

The colored shadows activity is rich with observations, but a good data collection scheme helps keep everything clear and understandable. Develop a data table that goes something like this:

Shadows with one lamp

Lamp Color	Shadow Color
Blue	Black
Red	Black
etc.	

Shadows with two lamps

Lamp 1	Lamp 2	Shadow 1	Shadow 2
Red	Blue	Blue	Red
Red	Yellow	Yellow	Red
etc.			

Shadows with three lamps

Lamp 1	Lamp 2	Lamp 3	Shadow 1	Shadow 2	Shadow 3
Red	Yellow	Blue	???	???	???



Keep Exploring!

Your kids may have noticed swirling rainbows on the surface of a soap bubble when blowing bubbles in sunlight. Have them try looking for rainbows in bubbles while in a room illuminated by a red spotlight only, or by a combination of the spotlights used in the above activity. What do they see?