Colours

We see millions of colours every day, but how does the white light from an LED or the yellowish light of the sun make that possible?

Age Group: 5yrs + (some cutting with scissors)

Method: Group activity (up to 15 per facilitator)

Level: Introductory

Duration: 25 min

Key Learnings: White light is actually made up of many different colours, and this is shown when light of different colours is mixed together.

Materials and Equipment

* Spinner template (I per participant)
* Scissors (1 per participant)
* Ruler (1 per participant)
* Cotton twine (0.75 - 1m per participant)
* Coloured felt pens
* 3 small torches
* Baking paper (1 A5 sheet)
* Stickytape
* Red, blue and green cellophane
* White surface (card or paper is OK)

Preparation

The facilitator should prepare for this workshop by making their own spinner using the instructions and materials provided. Experiment with getting the spinner to work – putting your fingers through the loop, holding it tight enough to make the disc stand up, and rolling the disc towards you to start a twist in the twine before gently pulling your hands apart. When the twine becomes an open loop, relax your hands and let the momentum of the spinner twist the twine in the opposite direction. As the spinner slows down, begin to apply gently and increasing pressure outwards to increase the spin. Repeat rhythmically to build speed.

Have a small object at hand (eg: an eraser, a matchbox, a bulldog clip) to make shadows with the coloured light from the torches. Participants can be encouraged to guess what colour shadows they will see with individual colours, and different combinations.

The coloured light works best in a darkened room, but if this is not available, then it is possible to use a large cardboard box to make a darkened viewing area. Consider how particpants will observe the effects if using a box – crowding may be an issue.

Have a rubbish bin ready for the waste card that will be generated.

Recommendations

Depending on the age and skill levels of the participants, it might be wise to have a couple of extra copies of the template at hand if cutting errors make completion impossible. The spinner works best if adjacent colours are contrasting, and a variety of colours is used.

Further learning could come from considering why mixing coloured paints produces a muddy grey, rather than white (reflected colours, from pigments, appear because the pigments absorb all colours except the one reflected. Mixing enough pigments means that eventually all the colours in white light will be absorbed, and the mixture looks dark.) Stage effects using coloured lights and shadows could be illustrated.

Workshop Outline

(5 min) Introduction

Introduce yourself, welcome participants and deal with housekeeping.

(10min) Combining colours

Ask participants if they have ever seen a rainbow, and explain that this shows that sunlight contains all the colours we see (and some we can’t). Begin with the demonstration, and get some participants to assist in cutting up the cellophane and black paper.

Cut 3 squares of baking paper a bit larger than the end of the torch, and a similar sized piece of each of the three colours of cellophane. Place one coloured piece of cellophane over each torch, and sticky tape it in place, making three torches that each shine a different colour. Place a piece of baking paper over the cellophane on each torch, and sticky tape it in place (this helps to diffuse the light).

In a darkened room (or other dark space), shine the torches onto a white surface (a piece of paper will do) to demonstrate that they produce a single colour. Now shine two torches simultaneously on the same spot, and observe what happens when the light combines.

Try different combinations of colours, and finally all 3 (a white spot should result), showing that white light is made up of different colours combined.

An additional activity would be to place a small object in front of the white surface, and shine different coloured light onto it. This time, look at the shadows.

(10 min) Make a colour spinner

Hand out spinner templates, and cut them to make a circle.

Each section is then coloured in with a different colour. Doubling up is OK, but make sure adjacent segments are different. As far as possible, do not leave any white spaces.

Use a pen or sharp pencil to punch two holes at the spots marked, about 5 – 10 mm each side of the centre of the circle. The holes need to be big enough for the twine to pass through.

Cut a piece of twine about a metre long for each participant (smaller pieces may be better for younger groups). When doubled, the twine should stretch loosely between outstretched hands.

Thread the twine through the holes, and tie the ends. Keep the knot at a distance from the spinner, so it can move freely.

Put a finger of each hand through the ends of the loop, and twist it a bit (try rolling the spinner towards you along the table tor floor as you hold the string). Now pull your hands apart gently, and the twist will make the spinner rotate. Relax the tension when the loop opens to allow the momentum of the spinner to wind the twine in the opposite direction. As the spinner begins to slow, apply outward pressure again, and repeat the process as the spinner builds speed.

Look at the spinner as it rotates – you should see it turn white when spinning rapidly, and may catch a glimpse of the colours as it slows down.

Explanation

When you look at the spinner, light is reflected into your eyes, and you see the colours that are not absorbed by the pigments. Different cells in the eye respond to different coloured light, and the brain has learned to interpret this as seeing particular colours. When the spinner is rotating rapidly, different colours are reflected into your eyes so fast that all the different receptor cells are responding at the same time, and the brain interprets this as the colour white. This explains how we see white as a colour, even though it is actually made up of light of all the colours of the rainbow.

Appendices: Materials suppliers list (attached)

Digital version of template sheet (attached)