Project:

Optics or the miracle of light and colours

Children of the age range of 3 – 10 years equally like optics, light and colours. With few means technical phenomena can be experienced and scientific facts clearly demonstrated.
The set of projects shown has no chronological order. Individual activities can rather be carried out independently of each other.
In regard to all products the principle of questioning action needs to be applied:
Solutions are to be developed by using materials, and should not be given in advance.
Taking the example of the periscope this means to invent a story in which the hero has to look around the corner.

According to constructive action all materials are laid out, and work as a group is required.

Beyond the scope of this Project creative elements such as light, shadow, play, mobile elements are particularly suitable to produce an attractive environment for children motivating them to research. It is desirable to work in line with Reggio.

Table of contents:

Name:

We make a periscope

Category:
Physics
- Optics

For age range:
6 to 10 years

For how many?:
Ca. 8 children

Where:
Demonstration room

How long:
15.15 until 16.00 hrs

Preparation/materials:
Get a pocket mirror and have it cut to size at the glazier's.
- Two pocket mirrors per child.
- One cardboard tube per child.
- Scotch tape.
- A cutter knife.
- Or a saw per child.

Aims for the children:
Children learn / understand why with a periscope you can look around the corner.
By working with the cutter the children learn to be careful with these things. fine motor skills is enhanced.
Confronting them with questions enables children to think for themselves.

Scientific explanation:
With a periscope you can look at objects which are outside of your field of vision. The rays of light radiating from the object in question penetrate the top of the periscope. The upper mirror reflects the rays inside the periscope down to the lower mirror, which again reflects them and sends them into the human eye.

Steps:
- Ask the children whether they know what a periscope is and what they can do with it.
- Explain to the children that a cutter knife is extremely sharp and that it is easy to hurt oneself.
- The children use the cutter to cut out the two rectangles of the periscope.
- Then the mirrors are fastened with scotch tape in these "holes".
- Afterwards experiments are made with the periscope to find out why it is possible too look around the corner / over a wall.

Be aware of:
It is absolutely necessary to assist when the cutter knife is used, or use small children saws from the outset. (Again assistance is required)

Possible variations:

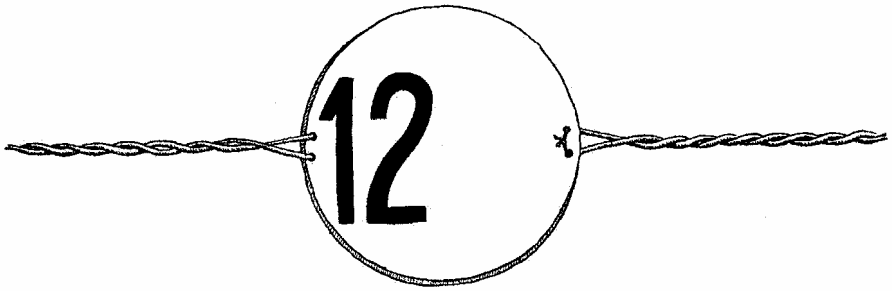
Reference:
Das Buch: 365 Experimente für jeden Tag
Verlag Moses

In detail:

<table>
<tr><td colspan="2">Name:

Turning disc</td><td>Category:
Physics
– Optics</td></tr>
<tr><td colspan="2">For age range:
4 years and older</td><td>For how many?:
4 children</td></tr>
<tr><td>Where:
Group room</td><td>How long: ca.
30 minutes</td><td>Preparation/materials:
Cardboard, coloured pencils, mercerized yarn, scissors, punch</td></tr>
<tr><td colspan="2">Aims for the children:
The children should understand that certain things can be seen only when performed at a certain speed.</td><td>Steps:
Cut out two circles of the same size. Paint some pictures. For example: 1. circle cage, 2. circle lion. Now the two circles are glued against each other upside down. I.e. one of the pictures always stands on its head. When painting the circles make sure, if possible, that similar forms are not too close to each other.
Punch holes ca. 1cm from the left and right edge of the disc. Pull a strong, 20 cm long yarn through them and tie their ends into a knot.</td></tr>
<tr><td colspan="2">Scientific explanation:
The eye is one of our most important sense organs. This experiment shows that our eye can only perceive a limited number of images per second separately.
Our eye can see up to 10 single images in one second. If this number is exceeded we start to perceive images blended into each other. This is for example how a cinema movie works.
The students can recognize this effect by using the thumb cinema or this image disc.</td><td>Possible variations:
Take some cardboard and cut out a circle of ca. 7 cm.
Write two arbitrary numbers on one side on the left half of the circle and on the back side two different numbers on the right half of the circle. You can also take small pictures instead of numbers.
Then take a refill for a ballpoint pen and drill two small holes into the edge of the circle next to the numbers just as shown below (cf. backside)
Pull a yarn through each side and make a knot.
One person holds the cardboard circle by pulling tightly at both yarn ends, while another person turns the circle until the yarn is strongly twisted.
Then let the cardboard circle go.</td></tr>
<tr><td colspan="2">Be aware of:
- By slightly tightening the two strings and twisting the whole thing between thumb and index the disc starts turning.
- You see both images simultaneously since the retina cannot process the individual images quickly enough so that both images are projected onto the retina at the same time. The effect is that the lion seems to be inside the cage.</td><td>Reference:
Sachunterricht be-greifen: Band 3 Klaus Hein, Claudia, Menzel, Ines Milardovic, Schneider Verlag Hohengehren Seite 100</td></tr>
</table>

In detail:



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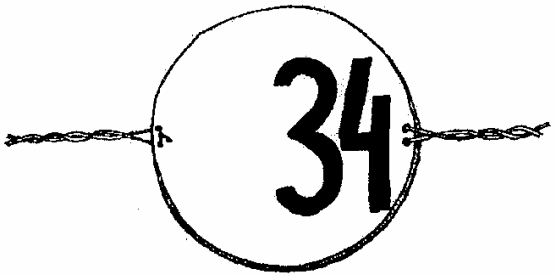

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<table>
<tr><td colspan="2">Name:

We make a water magnifying glass</td><td>Category:
Physics
– Optics</td></tr>
<tr><td colspan="2">For age range: 4 to 10 years</td><td>For how many?: ca. 8 children</td></tr>
<tr><td>Where:
Demonstration room</td><td>How long:
45 minutes</td><td>Preparation/materials: Story related to the water cycle, pencils and paper for the wall poster</td></tr>
<tr><td colspan="2">Aims for the children:
The children try to find out for themselves which materials a detective needs.
Let the children find out by experimenting on their own when objects under the magnifying glass become bigger.
Working as a team enhances their social competences.</td><td rowspan="2">Steps:
1. Every child cuts out two magnifying glass forms with the scissors.
2. Then use scotch tape to glue the foil onto the hole of one form and apply the second form to reinforce the structure.
3. Apply one drop of water onto the foil with the tweezers.
4. Thus you can magnify things / objects from the books.</td></tr>
<tr><td colspan="2">Scientific explanation:
The magnifying glass serves to look at small objects or supports the reading process. The “classical” magnifying glass consists of a convex lens held by a mounting ring with a handle. Some modern magnifying glasses may have several lenses (cf. lens formula) in order to avoid distortions which may occur when using lenses of smaller focal length.
The surface curvature of the drop magnifies everything you look at through the water drop!</td></tr>
<tr><td colspan="2" rowspan="2">Be aware of:</td><td>Possible variations:
As a variation you can make a large magnifying glass with a plastic bucket by cutting a large hole into one side where you can magnify even larger things / objects.</td></tr>
<tr><td>Reference:
http://www.physikfuerkids.de</td></tr>
</table>

In detail:

<table>
<tr><td colspan="2">Name:

We build a kaleidoscope</td><td>Category:
Physics
Optics</td></tr>
<tr><td colspan="2">For age range:
4 – 10 years</td><td>For how many?:
As of 6 children</td></tr>
<tr><td>Where:
In a room</td><td>How long:
ca. 30 minutes</td><td>Preparation/materials:
Sketch cardboard 30cmx15cm
Aluminium foil or
3 rectangular parts of a mirror
Double-sided scotch tape
Plastic sheet
Bits of coloured plastic film</td></tr>
<tr><td colspan="2">Aims for the children:
The children see how a mirror works.
The children see how creative new elements develop by the interaction of several mirrors.</td><td>Steps:
Adhere glossy aluminium foil onto a piece of cardboard of the size of 30 by 15 centimetres. Fold it in a way to get a triangular-shaped tube and bond it together (cf. drawing). Paste together the ends with transparent plastic foil. Place some bits of coloured plastic film onto the plastic foil and adhere some white paper to it so that the inlay bits of paper can still move. If you now hold this end of the kaleidoscope against daylight and look into it you can admire all sorts of different patterns produced by multiple reflection. When turning the tube they fall into ever new coloured patterns.</td></tr>
<tr><td colspan="2">Scientific explanation:
This is a kaleidoscope. The word “kaleidoscope” stems from the Greek language. Literally translated it means “the one who sees beautiful pictures” or “the one who looks at beautiful pictures”.

The symmetrical pattern in the kaleidoscope is produced through the reflecting prism in the kaleidoscope.</td><td>Possible variations:</td></tr>
<tr><td colspan="2">Be aware of:</td><td>Reference:
http://www.die-maus.de/sachgeschichten/kaleidoskop/</td></tr>
</table>

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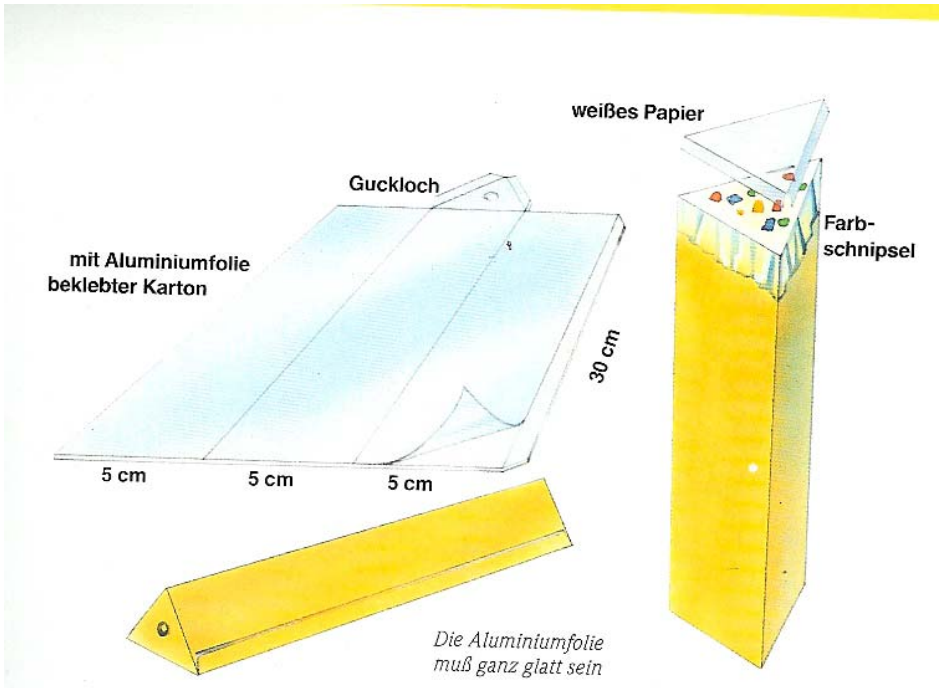

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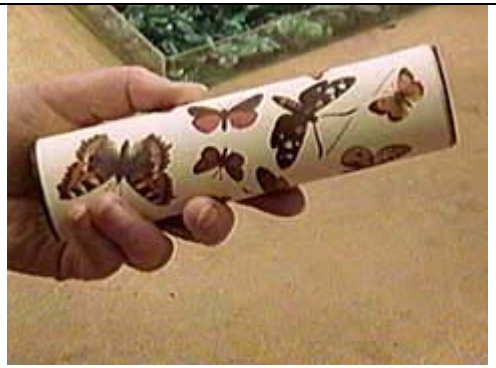

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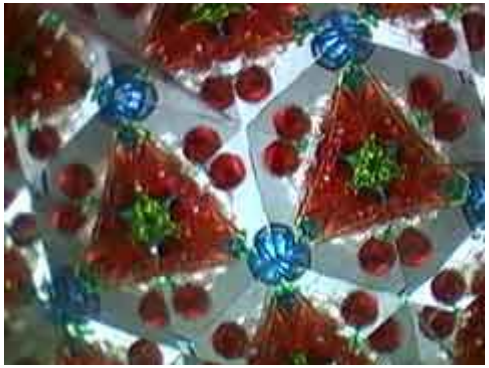

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