The position of the image

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Aims of the GP

To find the positions of images made by mirrors and lenses.
To find that images are REALLY there.

Teaching material

- A plane mirror - at the glazier's shop.
- A concave mirror - the "cosmetic" mirror in the bathroom fittings shop.
- A convex mirror - the rear mirror of a bicycle or of a car.
- A converging lens - a magnifying glass or spectacles for near vision.
- A diverging lens –spectacles for distant vision.

Age of the students

11-18

Preparation and teaching time

2 + 2 + 2 + 4 + 2 + 4 = 16 minutes altogether.

Lesson plan

1st step: looking out of the window (2 min).

Pupils look out of the window and hold a thumb upright in front of their face. They change their gaze from the thumb to the window frame and to buildings or trees outside the window.

They realize that they can see only one thing focused (depending on the distance to the object).

2nd step: a plane mirror (2 min).

Pupils hold a plane mirror and look at their hand and at the image of the hand in the mirror. Ask the students which object is closer to them. They find that their hand is closer than its image – so the image is BEHIND the mirror. It's a surprise for most of them.

3rd step: a convex mirror (2 min).

Pupils do the same as in the 2nd step. They can see that their image is also behind the mirror but it's closer than the one in the plane mirror.

4th step: a concave mirror (4 min).

Pupils look into the concave mirror. They see themselves upside down. Using the same trick as before they find that their image is IN FRONT OF the mirror. They touch the mirror – they can see the image of their finger. The image is BEHIND the mirror now.

5th step: a diverging lens (2 min)

Pupils look through the diverging lens and they can see that the images of both far and close objects are behind the lens.

6th step: a converging lens (4 min)

Pupils use the lens as a magnifying glass - look through the lens at some close object (their other hand, a book, a beetle, etc.). They can see that the image is behind the glass.

They look through the lens at some distant object (tree, teacher,...) and they can see that the image is closer to them than the lens (and also that it is upside down). So they don't really look through the lens but at something in front of the lens.

Questionnaire

If you stand 1 meter away from a flat mirror, your image is

- 1 meter away from you.
- 2 meters away from you.
- 0.5 meters away from you.

A magnifying glass can make images

- Smaller than the object.
- Bigger than the object.
- Of the same size as the object.

Can you make pictures on the wall with a mirror?

- No, it's impossible.
- Yes, using a concave mirror.
- Yes, using a convex mirror.

What can you use if you want to burn something?

- Matches.
- A concave mirror.
- A diverging lens.

The cars you can see in the rear mirror of your car seem to be

Smaller.

Closer.

Bigger.

If you look at an insect through the diverging glass

It seems to be bigger.

The image of the insect is behind the glass.

The image of the insect is inside the glass.

What kind of lens do you need to take a picture of the sky?

A diverging lens.

A converging lens.

Any kind of lenses.

If you look at distant objects through the diverging lens

They seem to be upside down.

They seem to be closer.

They seem to be smaller.

The surface of your eye (cornea) works as

A flat mirror.

A convex mirror.

A concave mirror.

Inside a camera there is

A converging lens.

A diverging lens.

A curved mirror.

Teacher reviews

Optics phenomena are always interesting to the students. The Portuguese teacher mentioned that after his initial difficulties in obtaining all the different kinds of mirrors, once the implementation started, he noticed a great interest among the students. They were curious to handle the lenses and mirrors and they enjoyed the hands-on approach of this GP. An interesting observation he made is that “some students who participate less in classroom activities were very active during the implementation of the GP, sharing very interesting

examples of their day to day activities and willing to perform the experiments with great care and attention". On the other hand, the Italian teacher mentioned that, instead of buying all the different types of mirrors, she tried to use as many objects as possible from everyday life that could act as a mirror or a lens, for example she used a spoon instead of a concave mirror. This little adaptation made the GP even closer to real life for students.

Something that shows how much the students enjoyed this GP is that the teachers noticed that some students shared their newly acquired knowledge with their families and friends, particularly with the people who wear glasses.

The SPICE project

SPICE was a two-year project (December 2009 – November 2011) carried out by **European Schoolnet** (http://europeanschoonet.org) together with **Direção Geral de Inovação e Desenvolvimento Curricular** (http://sitio.dgidc.min-edu.pt/Paginas/default.aspx) from Portugal and **Dum Zahranicnich Sluzeb MSMT** (http://www.dzs.cz/) from the Czech Republic.

The primary objective of the SPICE project was to collect, analyse, validate and share innovative pedagogical practices, particularly those using inquiry-based learning, whilst enhancing pupils' interest in the sciences. SPICE supported this objective by singling out, analysing and validating good practice pedagogies and practices in maths, science and technology (mostly ICT-based) and disseminating them across Europe. SPICE involved 24 teachers from 16 different educational systems (from 15 different countries). This teachers' panel helped the SPICE partners in defining good practices that were then tested in classes by 41 teachers during the school year 2010-2011.

For more information see: **http://spice.eun.org**

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