Magnetic properties of materials

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Subject: Physics.
Country of creation: Czech Republic.
Countries of testing: Portugal and Ireland.

Aims of the GP

Students should learn about magnets and their properties by using the puzzle-based learning method, which focuses on developing the student's problem-solving skills.

Teaching material

- A toy which works on the basis of magnetic forces.
- A4-format paper for each group.
- Two flip-chart papers. On the first is written "What we know about magnets", and in the second there is "What we would like to know".
- One magnet for each student (a small one is enough).
- Different kinds of tools connected with magnetism (i.e. loadstone, magnets of different shapes, sizes and colours, iron objects, objects which do not attract magnets, a glass of water and iron filings, a wooden board, an electric bell, etc.).

Age of the students

14-17

Preparation and teaching time

Preparation: 45 min. Class time: 2 x 50 min periods.

Lesson plan

1. Introduction to the topic (10 min).
   The teacher shows an experiment with a magnetic toy (i.e. as a wizard whose toy obeys his words).
   The teacher asks pupils how the toy works.
2. Teamwork – What I know about magnets and what I would like to know (10 min).
   Students will work in groups of 4. Each group gets one piece of A4-format paper and four small magnets. They have to fill in all that they already know

and what they would like to know about magnets on a flipchart in two columns.

3. Presentation of the students' work (15–20 min).
   Each group presents the information which has written down. If necessary the teacher corrects any incorrect information right away or he/she can leave it for the discussion in another lesson.
4. Conclusion of the lesson (5 min).
5. Division of the students into expert groups (10 min).
   In home groups students have to agree on who will work on which topic (who will become an expert on the given topic and then form expert groups).

a) Teamwork - Experts (30 min)

The student-experts familiarise themselves with the given tasks and questions and solve them together. Each of the groups has to work on one of the four questions mentioned below by carrying out an experiment such as magnetising an iron bar and doing some research such as:

- Does a compass always point to the North?
- Does the steel needle magnetise in the same way as the iron screw?
- Can a magnet be demagnetised?
- What surrounds a magnet?

At the end the expert groups agree on which information they will present to their home groups.

b) Reporting to home group (20 min)

Each expert presents the assignment and the solution to his home group and, by using the questions prepared; he/she makes sure that his home group understands the topic.

Questionnaire

Complete the statements correctly (more than one answer may be correct).

Magnets are attracted by

Gold / Silver / Steel / Wood / Iron / Another magnet / Plastic

... has magnetic power.

Lodestone A magnet A gold ring
An iron bolt in an inductor with electric current
Copper wire A lead plate Iron close to magnet

Two magnets repel each other when we bring close the:

North and south poles.
South poles.
North poles.
They don't repel each other.

A compass doesn't work properly

On the Moon.
In mountains.
When we bring it near another magnet.
On an iron bridge.
Under water.
It always functions properly.

A magnet is no longer a magnet when

We submerge it into water.
We hit the ground with it.
We break it in two parts.
A magnet is always a magnet.

Decide what is correct:

Each magnet has north and south poles.
True False

There is a magnetic field around the Earth.
True False

A magnet works at a distance, but it does not work through a barrier.
True False

Small magnets have small force.
True False

Magnets work even at a distance; the magnetic force decreases when the distance is increased.
True False

We can make a compass from a needle.
True False

Teacher reviews

This GP requires a set of materials, and organizational skills of the teacher in order to keep control over the home, expert and puzzle groups. However, the teachers who tried this GP did not report on any problems that they faced. The Portuguese teacher just mentioned that for the expert-group method she realized how important it is that all the members of the group work well, as that "could compromise the learning of other members of the home group". In most cases however, the teachers noticed that the method used in this GP

motivated the students to work well, as they had responsibility towards their groups.

On a different note, the Irish teacher said that the “task on magnetising the iron bar was very impressive” and that the students enjoyed it. As he saw his students working very well during the implementation of this GP, he even filmed the students while they were doing their experiments in order to create a video for them.

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**

Education and Culture DG
Lifelong Learning Programme

Spice was funded with support from the European Commission.
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