WHEN I AM DOING MYSELF, I UNDERSTAND BETTER

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1. INTRODUCTION

After the Revolution from 1998, in the Romanian schools the interest of students for exact sciences, including physics, dropped drastically. Many changes, including both topics and the number of hours allocated for study, have been performed in the curriculum of physics for high schools.

For example, before ’89 at classes with scientific profile, physics was studied 4 hours a week during the whole 4 years cycle and 2 hours a week for classes of other profiles during the same period. Curriculum included all the chapters of general physics: mechanics, thermodynamics, electricity and magnetism, optics, atomic and nuclear physics, solid-state physics, quantum mechanics and theory of relativity.

Today, at classes with scientific profile physics is studied 3 hours a week and the amount of information for students was reduced at about half of what was before ’89. General elements of solid-state physics and quantum mechanics are not included in curriculum. For the classes of other profiles, physics is studied 2 hours a week for the first two years only.

The education of physics in Romania is changing continuously. The best solutions for integration into European education are looked for. Our goal is to be prepared for the integration into the European Union from the educational viewpoint as well.

2. THE EXPERIENCE OF “STEFAN ODOBLEJA” HIGH SCHOOL IN TEACHING PHYSICS

It is generally accepted the idea that when you are doing something yourself you understand better in comparison with an explanation or a video presentation. Taking into account the suggestions and the proposals of the Comenius 3 Project “Hands on Science”, a group of students from “Stefan Odobleja” high school have been involved in manufacturing of various experimental devices used to reveal physical phenomena or to demonstrate specific laws of physics. Some of these devices will be presented below.

Electricity and magnetism are studied in the second course of high school. The students are 15 – 16 years old. They manufactured voltammeters, electrical circuits for demonstration of Ohm’s law and experimental devices to reveal the self-induction phenomenon. In Fig.1 one can see a few voltammeters manufactured by students. They used graphite electrodes, batteries and switches from shops. As electrolyte, $CuSO_4$ has been used.

The devices were manufactured individually or by a team of 2 – 3 students. All devices were presented and experimentally checked during a special class. The following evaluation criteria have been used: the manufacturing effort, the level of understanding of both theoretical and experimental aspects, the originality of the design and the aesthetic aspect. As a result of the evaluation each student has received a grade. After the first experience of this type of lessons, the interest of students in studying physics increased significantly.

The next objective was to build an experimental device to reveal the induction phenomenon, including self-induction (Fig.2).

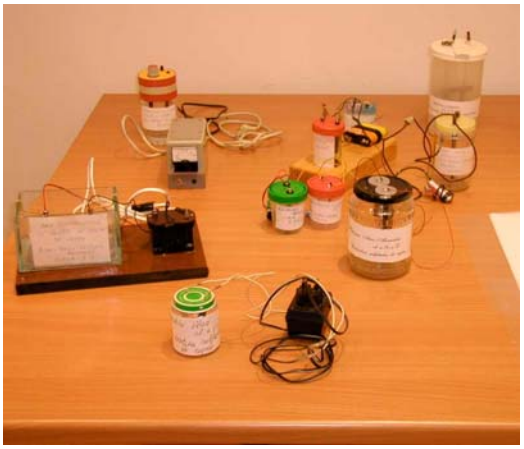

Fig.1 Voltammeters manufactured by students

Fig.2 Devices to reveal the induction phenomenon

A real competition appeared between the teams of students for the smartest device and the best presentation. Each device was analyzed and discussed in the class. The other students not involved in that particular project have made very interesting comments. As a matter of fact they evaluated the project and graded them.

Other devices were electrical circuits used to demonstrate Ohm's law (Fig.3).

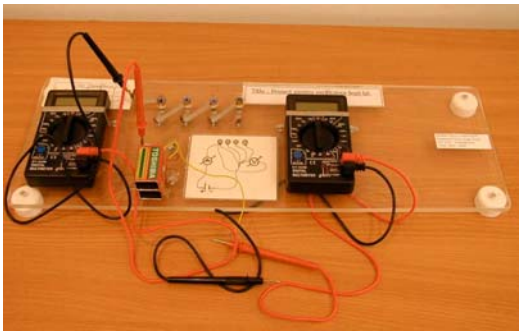

Fig.3 Electric circuit to demonstrate Ohm's law

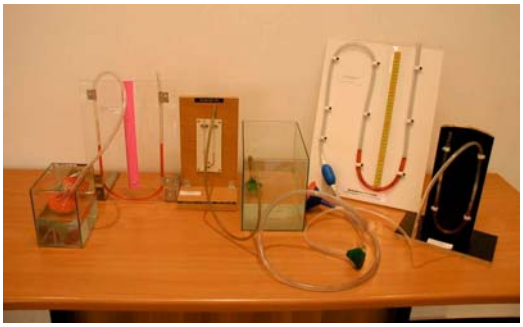

Fig.4 Liquid manometers

Fluid mechanics and the mechanical oscillations are studied in the third course of high school. Two projects have been developed with the students of this class. The objectives of these projects were:

- To build experimental devices for checking the fundamental principle of hydrostatics and
- To build gravitational pendulums and to measure the gravitational acceleration.

A few of the experimental devices are shown in Fig. 4.

In Fig.5 the gravitational and elastic pendulums are shown.

Each team filled in an experimental card. It contains the description of the experiment, the table with the experimental data, the calculation of the gravitational acceleration, the errors and their personal observations. They came to conclusion that what they manufactured was a physical pendulum and the conditions of isochronism were

not fully achieved. It should be pointed out that the students learned not only how to build an experimental device, but also how to use it, how to get the experimental data, how to process these data and how to conclude the results.

In the first course of high school they study mechanics. Only one project was developed with these students. They manufactured experimental devices for determination of the elastic coefficient of a spring. These elastic pendulums are shown in Fig.6. They measured the elastic forces, the deformations and they calculated the elastic coefficient of the spring.

Fig.5 Gravitational and elastic pendulums

Fig.6 Elastic pendulum

Each year, in April a special workshop and an exhibition are organized in the school and the devices are presented (Fig.7).
The exhibition is open three days and it is visited by all the students and teachers of the school.

Fig.7 Exhibition with experimental devices manufactured by students

Moreover, some teachers from other high schools are invited. This year, all this activity was carried out in the framework of Comenius 3 Project “Hands on Science”. The coordinator for Romania of the project attended the workshop. The best presentations were awarded prizes.

3. CONCLUSIONS

Manufacturing and use of the experimental devices help the students to understand better the phenomena and laws of physics.

The presentation of projects in front of their colleagues develops to the students the will of competition and the emulation.

The “Hands on Science” Comenius project created for students an organized framework to reveal their imagination, creative spirit and the practical skills.