MPTL14 2009
Udine 23-27 September 2009

MULTIMEDIA STUDENTS' PRESENTATIONS OF EVERYDAY PHENOMENA IN SECONDARY SCHOOLS

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Abstract
The use of ICT in secondary school is conditioned by the school´s technical equipment and students' individual ICT competences. Nowadays, parts of students' lab experiments are connected with interfaces like Logger Pro, or they are integrated by simulations, for example Crocodile Clips. A large part of students today know and are able to handle a digital camera, the internet, Power Point, and also manage to use 3D animations.
Among others, ICT has opened two big opportunities in teaching physics:
a) to investigate the pre-knowledge of students about phenomena
b) to elaborate phenomena on an interdisciplinary level.
Giving students the investigation of how birds fly, or how a canoeist rows on the water, or other similar issues as homework, proposing to apply all multimedia tools they know, one can observe that many of them have a very good competence in using ICT and they are also interested in analyzing various aspects of a phenomenon or a situation. From the observation of the process and from the material produced, a teacher can follow and understand how students approach observations and develop ideas and conclusions.

1. Introduction
Students of the secondary school don't have identical approaches to the observation and interpretation of everyday phenomena, and this is not influenced by the age of students. It is mainly conditioned by the students' experiences and their everyday activities. In the classrooms of our secondary schools today we can find many high-level athletes, musicians and students with unexpected competences in computers.
The materials presented here have been produced by two groups of students during the school year 2008/2009: 15-16 year old and 17-18 year old. At the beginning of the school year students received a list of everyday phenomena in order to observe them, and general indications about how to use ICT in their analysis of the phenomena. The choice of the theme and the approach how to study and elaborate the arguments were left to students' creativity, interpretation and interest. The work of the students developed in two phases: the first was the collection of data about the chosen phenomenon, and the second the presentation by Power Point in the classroom. The same list of phenomena was also given to students of age 17-18 with the same modalities of work. Since the main part of the topics was not specifically treated during the physics lessons, this meant that students approached the phenomena mostly with their own experiences.
The list of themes was the following:
1. How do swifts fly?
2. How do canoeists row?
3. How do balls rebound?
4. How is light reflected by objects?
5. How do oil spots behave on the water surface when its temperature rises?
6. How do bubbles run in the water and in the oil when its temperature rises?
7. How do glasses sound?
8. How can you take an object from the floor if you stand near a wall?
9. How does the shadow of a stick change during an autumn and during a winter day?
10. What happens with the duration of the day in the month of December?
11. How do bodies roll on an inclined plane?
12. How can you sink a plastic plate into the water?
13. How do you hear the sound of the train when it runs near you?
14. How does light pass through a hole?

The choices of the students were influenced by their attitudes and everyday activities because:
- students who were involved in sports outside the school chose themes 2 and 3
- students with computer competences chose 1, 5, 6 and 12

- themes which attracted students for curiosity reasons were 4, 9 and 10
- students interested in music chose 7 and 13
- students with some manual experiences chose 1, 8 and 11.

Each theme could be chosen just once by any student in the two classes.
The students had four months for collecting data with observation, videotaping, taking photos, measuring, making researches in the internet, books, constructing equipments or developing computer animations of the phenomenon. The teacher made a first evaluation of the proposed material after four months and suggestions gave to the students and indications how to proceed further. A month later the teacher announced the schedules of presentations in the classroom. The students had 20 minutes for presenting their work, including the discussion after the presentation.
During the first analysis of the materials it was evident that:

- some students approached a phenomenon by developing it as a lab experiment,
- a second group of students made a lot of photos and videotapes of different aspects of a phenomenon with just a quality interpretation of what they had observed,
- the "sports" oriented students used mainly aspects of their sports for explaining the phenomenon (Fig. 1). They also tried to explain some techniques used in their sports with physics arguments,
- the " computer" oriented students concentrated their attention to the reproduction of phenomena with different animations, trying to reproduce the entire process,
- students with manual abilities constructed some equipment for better reproducing the observed phenomena.

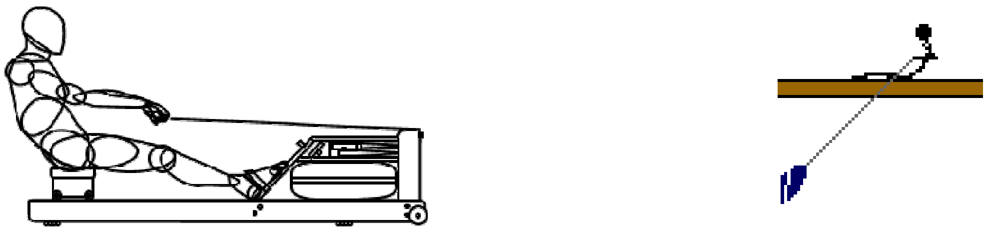

Figure 1: The movement and the animation of the canoeist in rowing

A large part of the students completed their presentations in the classroom by showing the experiment they had created at home using all kind of things, like kitchen or other tools or toys.

2. How do balls rebound?

This theme was chosen by two girls: one 15 year old (girl A) and a second 17 year old (girl B), who had also the sports-girl status, she practiced tennis. Both girls had as pre-knowledge concepts like the elastic energy of a spring, the force of gravity, kinetic and potential energies and friction.
Girl A chose a small, very elastic ball for her observations and let it fall from heights of 100 cm, 75 cm, 50 cm, 25 cm. She videotaped the ball rebounds and she deduced that:

- the number of rebounds doesn't depend on the initial height,
- each time the ball reached the maximal height in the videotape the image of the ball was focused, otherwise during the jump the images of the ball were blurred.

She collected the different heights reached by ball in each rebound in a table and calculated the differences between the heights for finding a regularity.
Girl B used three different tennis balls for her observations: a new one, a tennis ball with small elasticity used for children training, and a used-up ball. She also let fall balls from 100 cm, 75 cm, 50 cm and 25 cm of height and she videotaped the rebounds each time. During her presentation she put not the number of rebounds in the first place, but she linked the number of rebounds to the ball's elasticity. In her presentation she introduced a general formula for calculating the potential energy of the n^{th}-ball rebound, starting from the initial potential energy W_0. At the end of her presentation in the classroom she showed videos of her training where she used different techniques for changing the tennis ball rebound in a tennis play.

3. How does light pass through a hole?

This theme was chosen by a 16 year old boy and a 17 year old girl. Both of them didn't have any pre-knowledge about light phenomena.

The boy started his work by searching everything about light in Wikipedia. He found links to videos about water wave diffraction on different ridges, and laser light diffraction on small fissures. He reproduced the experiments himself by using a black pasteboard and a pin for making holes. He illuminated the pin hole with different laser lights: red, green and blue. He obtained a better image of diffraction with green laser light (Fig. 2). During his presentation he explained the experiments he had performed by using Bragg's formula.

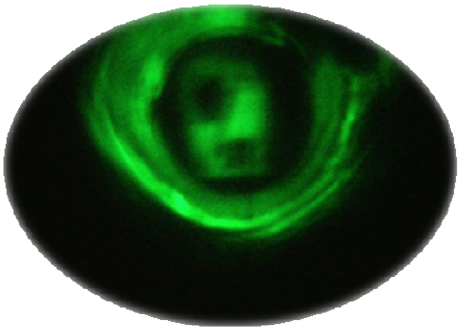

Figure 2: The diffraction of the green light laser through a pin hole

The girl started her observations by putting pieces of pasteboard with holes of 20 cm, 15 cm and 10 cm diameter in front of a white light lamp (Fig. 3). She observed the shadows on a white wall by moving the holes between the lamp and the wall. Very soon she was disappointed by the results because she observed nothing interesting. After a meeting with the teacher she decided to consult some physics books and she "discovered" light diffraction. During her presentation in the classroom she prepared a good Power Point presentation, and she insisted also in showing in the classroom the diffraction of a red laser light by a small hole made by a pin.

Figure 3: The shadow of a hole on the wall

4. The use of computer animations for understanding everyday phenomena

Some students, mainly boys, tried to explain the phenomena by reproducing them with computer animations, also in 3D (e.g., Studio Max)

By analyzing the animations which reproduced the flight of a bird when it takes off until its landing, or the sequences of the canoeist's rowing, or changes of oil spots on the water surface with temperature, or the different bubble velocities in the water or in the oil, we can observe that students:

- know how to use models,
- are interested in reproducing the process completely, not just some parts of it,
- understand that ICT has an important role in comprehending phenomena,
- a large part of the students use ICT for understanding and observing the phenomena, a small part of the students are able to use it as an instrument of research.

The analysis of the materials produced showed that younger students elaborated their ideas better or with more examples than the older ones. One can deduce that experiences are not influenced by their age but mainly by the activities students perform, and this gives them independence and a good base for reasoning in science.

5. Conclusions

The use of the ICT in the classroom opens a new view in teaching science. In an interdisciplinary way students have the opportunity to show their competences to the teacher, but also their problems in approaching everyday phenomena. The comprehension of phenomena and their interpretation are conditioned by students' everyday activities, experiences and attitudes.

In the phase of adolescence, students are interested in understanding the entire phenomena, not only its "physics" part, and they wish to use science as a tool which could permit them to understand why some things happen, and how to use it for reaching better results, for example in their sports.

From the didactical aspect, ICT is a good instrument for teachers to investigate the student's pre-knowledge which could help her/him to organize her/his teaching in a constructivistic way.

6. References

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