

FOR WHAT, WHEN AND HOW ICT SHOULD BE USED IN PHYSICS TEACHING?

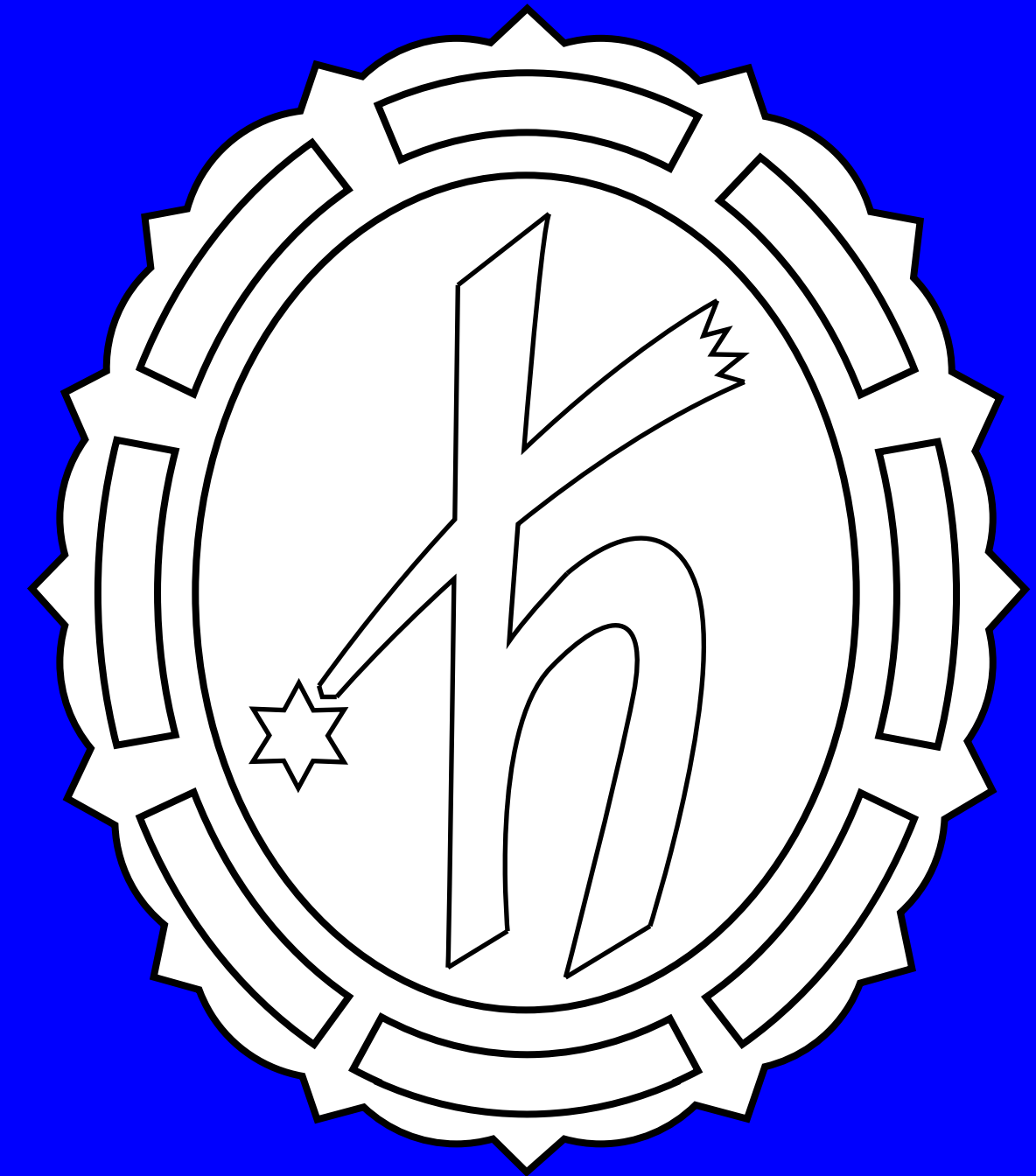


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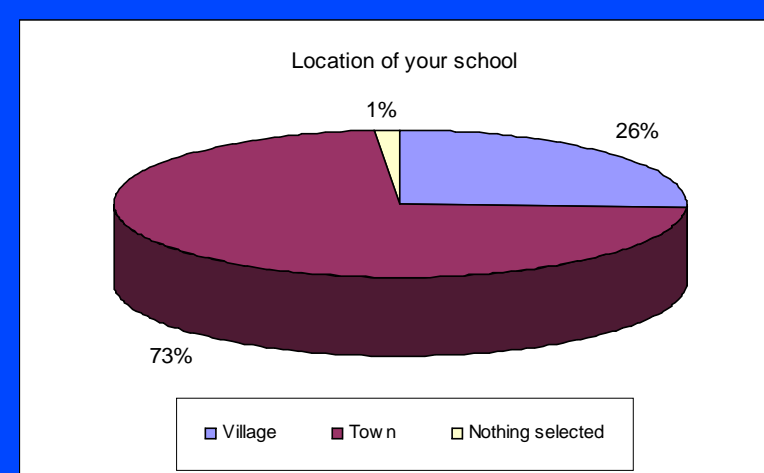
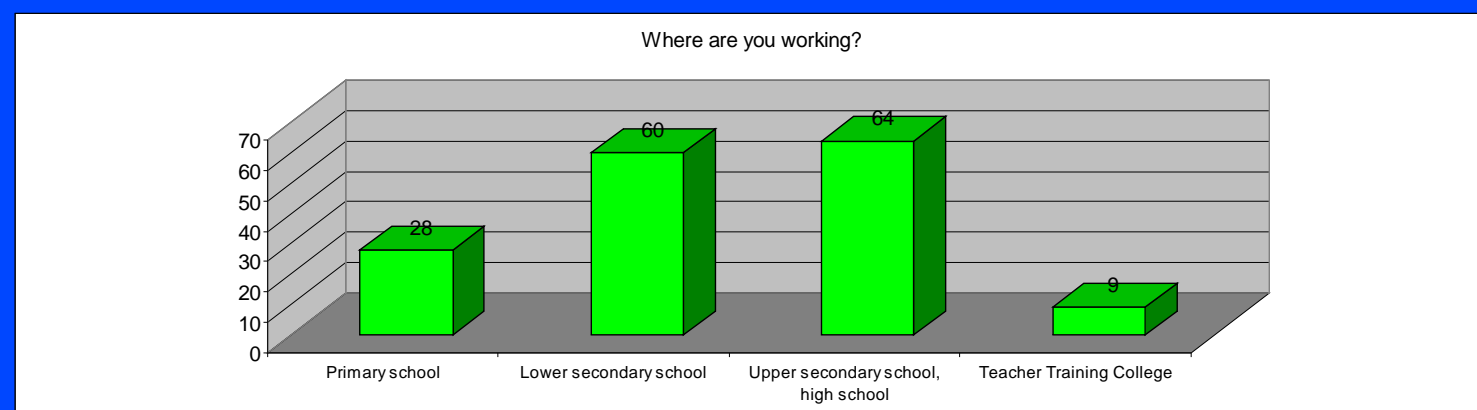
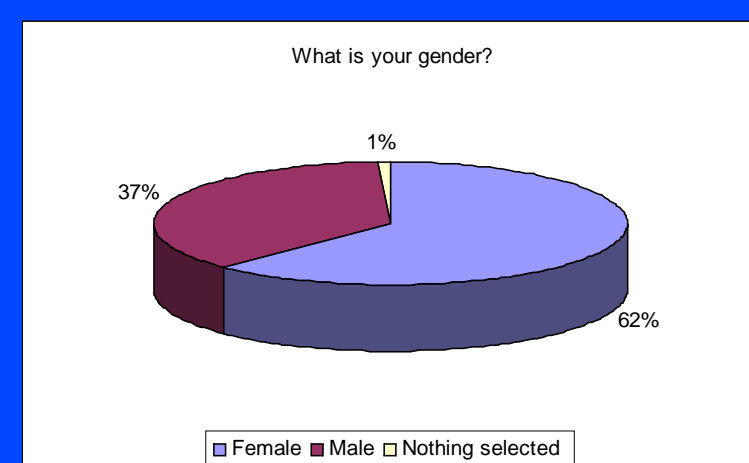


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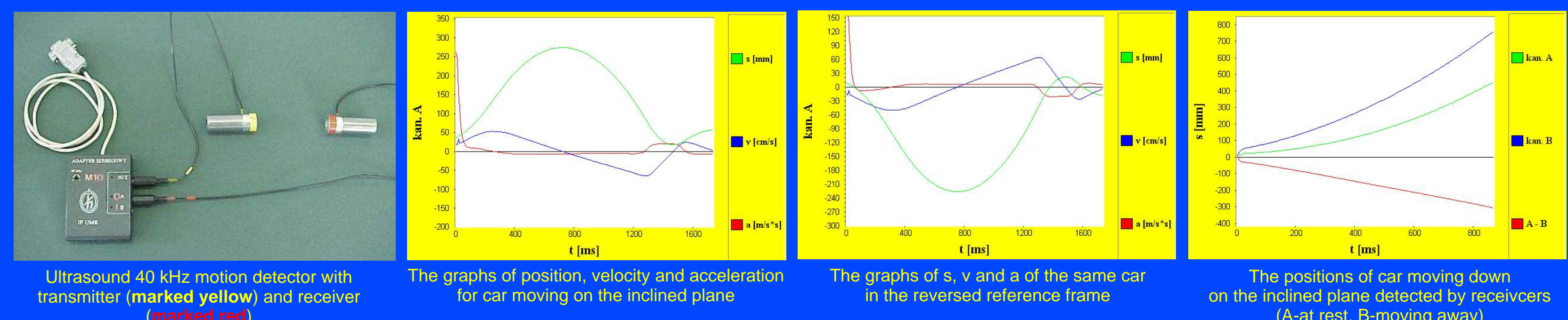


EU-ISE International Questionnaire for teachers Making the use of ICT in science teaching Results of Poland



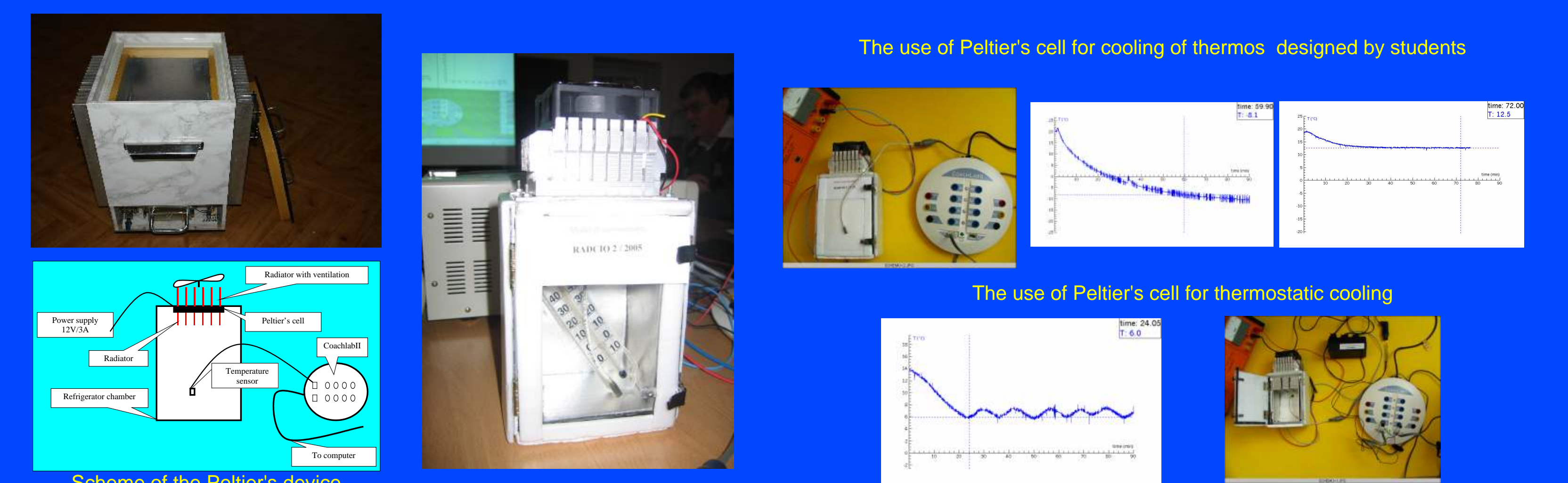
Experiments with the use of ultrasound motion detector

To investigate the position, velocity and acceleration of moving bodies we are using inexpensive ultrasound motion detector working with continuous, coherent wave of 40 kHz frequency. The detector has microcontroller PIC 16C84, EEPROM memory and ultrasound transmitter and receiver. Using this equipment we can obtain the distance measurements with the resolution below 0.2 mm, time with the resolution of 300 μ s and a computer can calculate the velocity with the relative error about 1 %.



Ecological refrigerator Model of a smart refrigerator for environmental education

In this experiment we would like to emphasise the educational value of experiments using the Seebeck-Peltier's semiconductor junctions. For this purpose we constructed the working model of the heat pump consisting of the two commercially available Peltier's batteries connected in a cascade. With this device one can demonstrate heating with the efficiency greater than 100%, cooling without ecologically undesirable noise and freons as well as the reversibility of the observed phenomena. It can be used as a refrigerator or heater by simply changing the direction of electric current, but at the same time it can also generate electric current if we keep junctions at different temperatures. With their inherent flexibility Peltier's elements have already found numerous practical applications, such as: thermostats with the accuracy of millidegrees, micro-refrigerators for small temperature sensitive devices or very precise micro-positioning. Thus, they are of a good examples to demonstrate to our students how modern material engineering, based on the principles known more than 150 years ago can be very useful now.



Infralogger – infrasound detector

In 2002 in the Institute of Physics NCU we have constructed computer aided special device for investigation of infrasound (in the range 20Hz-0.01Hz). Computer software for registration of sound signals, which can be analysed with the programmes Cool Edit, Goldwave, Origin. Having such device to the disposal we can detect and register sounds, which we don't hear, but they are danger. We would like to add, that infrasounds can't be detected by the ordinary microphone.



The main advantages of the use of ICT in physics education

If the methods and tools of ICT have a good quality from the technical point of you we can try to find some general and pedagogical features, which allow us to answer the question:
For what, when and how ICT should be used in science (physics) education?

I. General and subject aspects

For what?	When?	How?
To modernize and extend knowledge and skills of students by the use of modern technology	If the school curriculum is outdated or the school laboratory is not sufficiently equipped	By the use of Internet resources including virtual and distance learning
To stress some essential goals of education, including education on important global problems	If there is necessity to exchange the ideas by students from all over the world on issues concerned with common topics	Discussion forum with the use of Internet
For better (deeper) understanding of difficult physics concepts	If the students have a lot of preconceptions and misconceptions	The use of simulations, modelling, databases, interactive video, MBL exp., data logging
To use the time of learning more effectively	When there is low number of hours devoted to physics teaching	Software designed in the way to save the time of learning
To promote active collaboration of students in teams	When students don't have ability to work in groups	To apply different computer aided student project's work

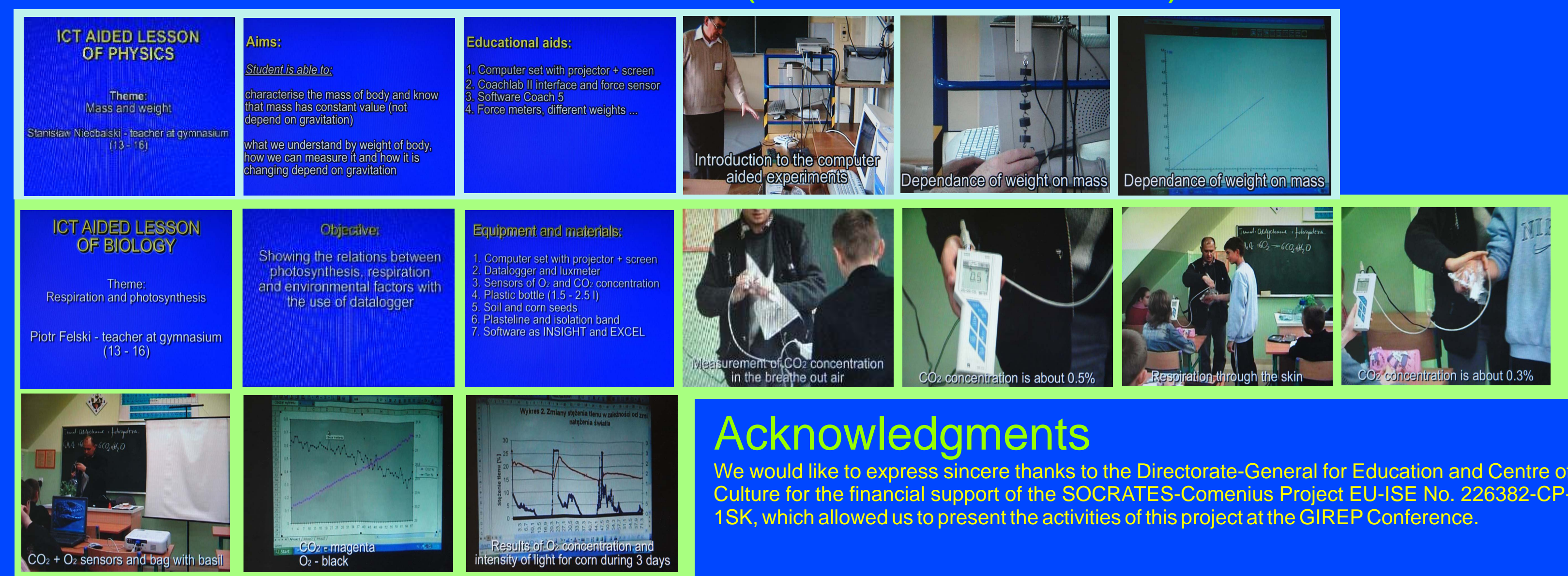
II. Pedagogical aspects

For what?	When?	How?
To adjust teaching to the individual knowledge and abilities of students	When traditional methods don't offer differentiation of teaching	To elaborate different options of work (menu options) with software
To make learning much more active	If teaching-learning process is passive	To provide interactive learning by feedback of students with software
To increase the effectiveness of teaching	If traditional teaching is not effective	To create multimedia and MBL methods using the pedagogical rules

Summary – for what ICT in science

- attract, arise interest, motivate students,
- increase effectiveness of work in science laboratory,
- encourage for answering the question "What will be, if..." instead of performing tasks following instruction as from the recipe book,
- increase memorising and understanding of knowledge by the feedback of students with software,
- facilitate school curricula realisation due to the integration of ICT methods with the study contents,
- to provide application of multimedia methods,
- assure apply simulation, modelling and investigation of phenomena in the real time,
- assure individual work of students, which allows to construct their own knowledge by creative exploration,
- cause association of computer aided work with simplifying of science understanding, as computer helps to solve ordinary as well as complicated problems,
- allow students to extend their knowledge also beyond the computer resources.

Lessons with ICT (screenshots of films)



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