School Science Mini MBL Project aimed at increasing the efficiency of teaching

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In the year 1999 the Polish educational system was reformed and the use of ICT for science education was introduced into the core curricula. As the result in the years 1999 – 2001 all lower secondary schools were equipped with computers, but unfortunately, they are used mostly for learning only the basic ICT skills. The lack of good quality educational software and laboratory equipment as well as low level of teachers' competencies in the effective use of ICT has resulted in no improvement the quality of science education in Poland. Taking this into account and moreover the official decision of EU Council dated 5th December 2003 promoting an efficient use of ICT for educational purposes, we created the network of 3 Universities (Poznan, Bialystok and Torun) working on improvements in this matter. Each university is collaborating with the group of 10 – 15 science (physics, chemistry and biology) teachers elaborating the examples of Microcomputer Based Laboratory (MBL) methods and tools applied to science teaching. The effectiveness of these methods and tools in process of science teaching and learning is very well documented in the literature [1-6].

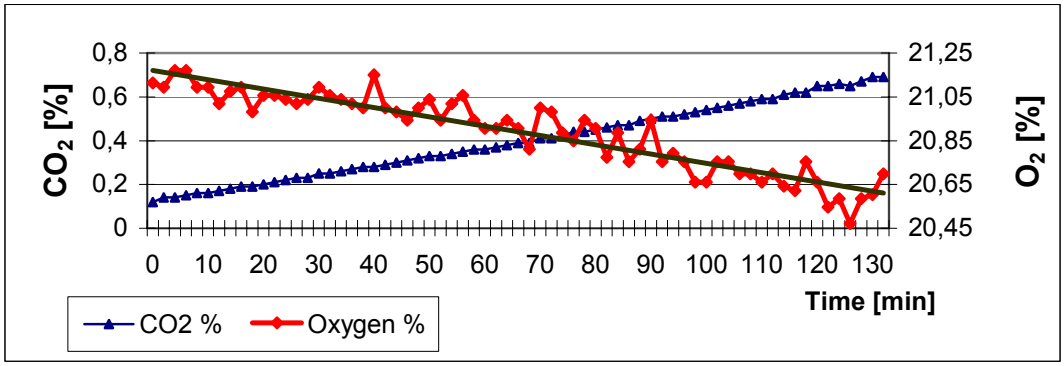
Based on the classroom experience, which reflected students' difficulties with the understanding of particular physics concepts, when presented in the traditional way, teachers first were planning the topics of their ICT based activities. Thus, the most important for the selected topics were assumed educational objectives. Due to the National Ministry of Education and Sport support, schools collaborating with us were provided with some necessary equipment (interfaces, sensors, video cameras, etc) and appropriate software. In that way school science mini Microcomputer Based Laboratories (for the first time to such extend in Poland) were created. The training courses to acknowledge teachers with abilities to use the MBL methods and tools (in our case based mostly on CMA, Amsterdam equipment) were organised. The execution of the project is due the course. The work results (in the form of experiments and their theoretical descriptions) are presented and discussed during our consecutive meetings with teachers. They will trialled at schools in the autumn.

Let's present some interesting effects of our Project, in which the teachers from Kujawsko-Pomorskie Region are involved.

One of the most experienced physics teachers elaborated the full list of MBL experiments, which can be performed at the gymnasium school, according to the content of curricula at this level. In fact, it is a mature conception: when, for what, and how the MBL should be used to support the effectiveness of teaching and learning. Another physics teachers have selected rather only one or few MBL experiments, which are in their opinion worth to propose, as for example: "Gas laws verification", "Different electrical batteries life investigations", "Studies of relative magnetic permeability of different substances", "Studies of magnet falling down in tubes made from different materials", etc.

Let's describe shortly the last experiment devoted to the MBL investigation of strong magnet falling down in plastic, copper and aluminium tubes. The motion of strong magnets inside a metal tubes induce an electromagnetic force, which has influence on falling down motion parameters - velocity and acceleration. We can measure the values of downfall time and induced potentials using CoachLab II interface with Coach 5 software [7] and evaluate the *g* value. Furthermore, we can compare the motion parameters for magnet falling down only in the gravitation field (inside a plastic tube) with a motion inside diamagnetic and paramagnetic metal tubes. Calculation of induced potential in copper and aluminium tubes give us a chance for verification of induction phenomena and Lenz' principle. On-line data and graphs illustrate change of induced potential in different tubes.

The other MBL experiments were proposed by the biology teachers in collaboration with us. First is concerned with the investigation of photosynthesis and respiration of plants. This experiment allow to investigate the changes of oxygen and carbon dioxide concentrations as a function of absorbed light energy for corn growing in a plastic bottle. In this activity we also used CoachLab II interface, the oxygen and CO_2 sensors. In the picture below the plots of oxygen and CO_2 concentrations for corn growing in darkness are presented.



The obtained results allow students to withdrawn conclusion, that the plants have to respire also at the night (in darkness). Furthermore, precise analysis of the achieved data permit also to find the relation between O_2 and CO_2 concentrations. The plants respire using the oxygen and dose out CO_2 in proportion 1:1.

The other biological experiments are related to oxygen process of plants germination and non-oxygen – alcoholic fermentation of *Saccharomyces*, as well as to investigations of the influence of different medicaments on pH of stomach acid. In addition to physics and biological experiments, one chemistry teacher proposed to investigate in details the process of milk as well as wine fermentation.

References

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