ICT, MULTIMEDIA USED IN THE NATIONAL AND INTERNATIONAL EDUCATIONAL PROJECTS

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1. SUMMARY

The education of natural sciences is in crisis in the world. This fact has already been recognized in 2000, but even in spite of the big efforts already done it was not possible to make positive changes. I performed a survey among high school pupils and teachers in 2003 to evaluate their attitude towards sciences. As a conclusion of the survey it has become clear that a new method has to be found, which can change the students' attitude related to natural sciences [1-4].

Analyzing the results of the survey I have concluded, that only the combined use of the project method, the ICT (Information Communication Technology) and the use of the digital educational content is promising to change the students' attitude and their orientation towards the world of science.

The following coordinated, national and international projects helped to reach the formulated aim, that the students become more creative, innovated thinkers, unifying their experimental, theoretical, mathematical, knowledge:

- Human – infra diagnostics,
- Whole body counting,
- Measurements of environmental materials,
- Alice in Chemistryland – Science on Stage Hungary,
- XPERIMANIA I, II, III,
- e-Skills,
- SPICE

In this paper only some parts of selected projects can be described in detail.

2. INTRODUCTION

Globalization and technological change processes have accelerated enormously in the past fifteen years; therefore the use of ICT in education became a common requirement.

The effective integration of ICT into the educational system is a complex process that involves the followings: curriculum and pedagogy, institutional readiness, teacher competencies, and long-term financing, among others.

The effective use of Information and Communication Technology (ICT) in Hungarian secondary schools has been started in 1998, when the majority of the schools has been connected to the internet (The idea of the school connection – the first Hungarian Schoolnet project – has been announced in 1996).

During my educational career I also became confident that it was impossible to adequately teach some parts of physics (e.g. chain reaction [5]) and related natural sciences without the use of computers, video files and simulation programs. Some say that computers are not necessary if you have a decent teacher. Others fear that teachers will no longer instruct but, rather, leave everything to the student and the computer. These objections are understandable, but it can no longer be misunderstood: computers are essential to even moderate levels of instruction in the world at this time [1-4].

Computer simulation programs offer a unique opportunity for students to see and work with systems and substances that they would rarely, if ever, be able to actually practice with in reality. Dangerous substances and situations, expensive equipment, and theoretical, even fantastical, ideas can be explored in a way that is more thorough than practical teaching has ever been able to do before. Never before has there been a situation in which the creative mind could be so safely and precisely indulged in this most important area of education.

These benefits of computer simulation programs must not be misunderstood to mean that a computer can be the sole provider of instruction for students of physics and natural sciences! Nothing can replace the experience and the personality of a good physics teacher [5, 6-7]!

However, a physics teacher is human and subject to the laws of space and time. Students, who are slower or faster, have the benefit of working on more, or less, advanced experiments regardless of the pace of the class. This is particularly helpful for students who need to practice material in which the class has already covered. Slower learners can continue to explore previous experiments without needing the classroom instruction to be repeated again and again. They can replicate experiments until they actually see the correct results. Likewise, advanced learners have the freedom to experiment on subjects that may not be understood by the majority of the class yet. In both cases the slower, and the faster students of a class benefit from the new methodology of combining the power of the computer with the wisdom of the teacher.

We are confident that the role of the teachers and students should be changed. Using cooperative learning and also project method all students are equal partners with the teachers, and teachers become mentors who will guide their students. Everybody in a team is a learner, and everybody has a responsibility, and also teachers and students can learn from each-other [5-10].

Practicing the method I also understand that behind any cooperative activity there should be experimental, theoretical, mathematical, IT and social task in all cases. All skills are very important. The theoretical, and mathematical task is concentrated more on the lexical knowledge which can be learnt from the book or from the internet, but the experimental and social tasks could not be learnt, but can be achieved and expanded only in real practice. Using collaborative learning method we all can help our students or colleagues to develop their social skills and to become successful learners, confident individuals and responsible citizens.

With the help of the innovation – the attitude improving projects – we can come closer to the goal of having students who are autonomous, have a creative way of thinking and by integrating their experimental, theoretical, mathematical and IT skills are able to have proficiency of knowledge that is universal and useful.

3. MEASUREMENTS OF THE ENVIRONMENTAL MATERIALS

Measurements of the environmental activity concentration by gamma-ray spectrometers require the determination of the **full-energy-peak efficiency η,** as a function of photon energy over the region for which the detector is suitable. This can be done either **experimentally** or **by calculation**. For very simple cases (single gamma-transition, point-like source positioned far from a simple shaped detector, etc.) its determination is quite straightforward. In this case a unique $\eta(E_\gamma)$ function characterises the detection efficiency. However, if the decay scheme of the studied nucleus is more complex, cascade effects modify the detection efficiency. Similarly, the actual detection efficiency depends on the actual detection geometry e.g. (extended source), on the self-absorption occuring in the material of the source, and so on.

All these effects are generally treated as corrections or modifications of the simplest case values. These modifications are especially relevant when applied for large volume samples of environmental origin.

Corrections due to self-absorption and cascade coincidence phenomena can be accomplished by means of various theoretical, empirical and experimental procedures. This study attempts to summarise the state-of-the-art and offers an elaborate solution of Monte Carlo simulation by carefully tailoring its input to the actual problem.

The experimental determination of the detector efficiency with calibration sources is usually easier and more accurate than with calculations. However, there are cases when a measurement is just not possible either because no calibration sources are available, or they can not be prepared. In such a situation calculations (simulations) have to be used.

In this work during our research activity made with the students we performed only the experimental situations. All measurements were done at the Institute of Nuclear Techniques of Technical University Budapest (INT TUB). All work consisted of a research project which could not be done without a strong team work [11-14].

The aim of our project focused in:

- measurements of water samples
- measurements of fall-out
- measurements of aerosol samples
- qualitative measurements of radon concentration
- measurements of building materials in Marinelli beaker

Before the measurements of water samples first we had to know the followings:

- which techniques of measurements will we use (Aluminium dish and Marinelli baker)

- which types of detectors will we use (detectors with low-background chamber
- why would we like to examine water samples
- first to register the background
- if the efficiency of the detectors has already been determined
- to calibrate the equipment

The reason why we decided to work on this topic was the following: because in the water-natural radioactive isotopes appear, originating from aerosol particles falling from the air, landing in the water: ^{40}K, U_{nat} and radionuclides belonging to the ^{232}Th decay chain.
The water sample has been collected from the following places: Danube (Budapest), Lukács spa (Budapest), Hajdúszoboszló spa, Hévíz spa, Mátra-Rákóczi-fountain, Lake Balaton, Nyírbátor spa, Mezőcsát spa.

My students – research group:
(used the following)

method: beta, gamma-spectrometry

equipments: highly efficient alpha, beta, gamma-spectrometer with low background

Multichannel Analyzers
(with specific computer program)

Detectors: Intelligent Scintillation Detector, HPGe low background chamber

This project has been performed by 3 students, who reported their result in front of their classmates and schoolmates at a national and international competition organized by MILSET (http://ese2010.ru/)
The measured water sample was first evaporated and measured with two different types of detector, more than 24 hours.

After the measurements we concluded that:

- the gamma intensity was not significant in any of the measured samples,
- the measured values were very different from each – other
- the efficiency of the sandwich detector was much better than that of the HpGe detector, therefore the measured samples resulted only the net measured beta intensity in the spectrum which was not significantly detectable
- the sandwich detector could not recognize the isotopes well, therefore measurements with HpGe detector were necessary.

4. XPERIMANIA I, II PROJECT

4.1 XPERIMANIA I

As a Hungarian National coordinator I had opportunity to involve my students (and also other students and teachers from my country) to another big international project called XPERIMANIA, launched by the European Schoolnet (http://www.eun.org) Another advantage of the project was that any of the EU official languages (except Irish), plus a translation of the title into English could be used.

The Xperimania project was organised by the Association of Petrochemicals Producers in Europe (Appe), and coordinated by European Schoolnet on their behalf. All schools in the European Union, candidate countries and EFTA countries were invited to join in. The aim of this project was to help students in lower and secondary school classes (covering pupils aged 10-20) and their teachers to understand the wide variety of applications of physics and petrochemistry and how this relatively new and fascinating science has contributed to the evolution of many day-to-day items. It is well known that this project could not be assessed, and worked out without the ICT techniques. Students can choose between two different categories where to participate:

Timeline Competition (http://www.xperimania.net/ww/en/pub/xperimania/timeline.cfm):
Teachers and students were invited to explore a scientific discovery in the field of materials from 1800 to the present day. The objective was to investigate a discovery and try to imagine what an application looked like when it became available. Teachers and pupils needed to produce a digital resource describing what they have found out about the discovery. The entry had to include a short text and a picture. They could also make a film, audio file, visual resources or text-based document to illustrate their work. Once uploaded to the website the entry became part of an interactive timeline of discoveries in materials (from pvc to nylon and Kevlar).

Experiment Competition (http://www.xperimania.net/ww/en/pub/xperimania/competition.cfm):
Teachers and students were invited to set up an easy and fun experiment in science to investigate the properties of materials. The lab report then had to be uploaded together with a video, or photographs on the website. All the submissions of the competition were displayed in an online gallery. The competition was focused on classroom and laboratory activities, therefore af-

ter announcing the competition some examples of experiments and requirements has been shown for the participants. All experiments had to have material properties (chemical or physical) and / or the chemistry of modern products as a focus. The topics engaged pupils in an inquiry-based learning approach, which was shown to have a highly positive impact on their motivation. In the experimental part of the project, participation of teams of maximum 3 students was expected. In this case the use of the project method was very useful, because students having good multimedia skills were mixed with students who had good experimental competencies. All students were able to do the activities that they enjoyed the most. I would like to mention that this project gave us a very good view about the role of the teachers. The teachers did not make frontal classes! Teachers assisted their pupils to get prepared for the activity by following these steps:

- Engaging pupils in preparatory discussions about the experiments proposed for two age groups: age group 1 (10-14 years) and age group 2 (15-20 years).
- Identifying a topic to work on.
- Referring to relevant organisations like Science Museums or companies, making contacts and arranging local activities such as field trips or presentations at school.
- Running the experimental activity.
- Preparing the contribution with the appropriate software.
- Uploading the contribution to the Xperimania competition website.

All students were invited to upload their lab report (in pdf format) and other files (picture in jpg format, PowerPoint presentation or video file converted to swf format) on the official competition website (http://www.xperimania.net). All the submissions of the competition were displayed, and it is still visible in an online gallery and the best entries were rewarded by a prize.

Conclusion

In the 2007/2008 school year 1000 secondary school students from 18 European countries participated in the XPERIMANIA I project initiated by EUN (European Schoolnet). Totally 447 submissions (154 Hungarian submissions – the most) have been uploaded. An international team of teachers made a pre-selection of finalists, while an expert panel selected the overall winners. The panel consisted of top level representatives from the European Chemical Industry Council (Cefic), European Schoolnet experts and a representative of the Flemish Ministry of Education in Belgium. The winners and runner-ups were awarded in a prize ceremony organized in Brussels, Belgium on 16 September 2008 at the Museum of Natural Sciences, where all winners had the opportunity to visit the world's most famous dinosaur gallery.

As a Hungarian National coordinator I am very proud, because two of the six European prizes, plus a special mention, belong to our small country. The jury selected the experiment of two Hungarian students, Péter Holányi and Hajna Takács as the first runner up: "Surprise, Investigation and Research in connection with the Polyethylene".

The "Timeline" competition invited students to explore a historical discovery in the field of materials and petrochemistry. As the first runner-up, the jury selected the entry "Bitumen" provided by Mátyás Molnár from Hungary. In addition, the jury gave two special mentions. The Hungarian project: "Tyre", was nominated with the "Special mention for link to daily life".

Beside the experiments and research activities, the communication skills of the students were also developed. During the project four possibilities have been offered to participants who registered before, to take part in online chat and ask their questions formulated in advance. During the chat the discussions were moderated, and well known experts have been invited to answer the students' questions.

4.2 XPERIMANIA II

The "Check out the property!" competition was open for secondary school students aged 10-20 years. In groups of maximum 2 or 3 they had to research a property – such as lightweight, water resistance or energy efficiency (a list of properties is provided on the website) – find out a way to test it and explain the results in a clear and structured way in a lab report. The lab report uploaded on the XPERIMANIA online gallery had to be accompanied with an image, video or other multimedia documentation of the test process.

All the submissions uploaded on the website before 30 April 2009 were evaluated, and the best entries were awarded with a personal media player for each student and a stipend for their school to be spent on scientific classroom resources.

5. CONCLUSION

Use of the ICT in Education combined with the project method could be a promising asset to modernize the teaching of physics and make natural sciences more attractive by engaging multimedia and Internet communication. I am confident that the applied method and the described projects highly changed the attitude of the students for the natural sciences and their mind started to open the doors for science.
“Effective learning in the classroom depends on the teacher's ability ... to maintain the interest that brought students to the course in the first place” [15].

6. LIST OF REFERENCES

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