

Successful Experience and Good Practices in Teaching Chemistry at Schools in the Czech Republic

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Abstract

Educational system of the Czech Republic faces many problems and challenges not only in the field of natural sciences. However, successful experiences in chemistry teaching can be found. For example, students of primary and secondary schools who achieved great results in national and international competitions; teachers interested in lifelong learning; successful experts and their wonderful research; national and international projects promoting chemistry teaching; many excellent chemical high schools and universities; increasing support for ICT teaching (new portals with many educational resources for students and teachers) etc. Czech media and society do not talk enough about teaching and research successes. The paper tries to report on some successful examples of good practice that could help to improve students' attitude towards chemistry.

1. Introduction

Czech education has a long tradition. First schools appeared at the beginning of the 10th century. Czech educational system used to be known for its excellent quality and competitiveness. [1] However, this reputation has been declining in the long term. The reasons for this state are: unstable political situation, changes and reforms in educational system, changes in the Czech society etc. The good news is that the government as well as teachers and experts recognized this alarming state. There are efforts to improve the state and get better reputation and competitiveness for Czech education system back. Many difficulties and problems connected with education were discussed in previous papers. This paper is focused on successful experiences, i.e. successful students, chemistry teachers, schools, scientific researches, projects etc. We focus just on the most successful experiences since it is even impossible to mention all of them.

2. Successful experiences and good practice in teaching chemistry at Czech schools

For better clarity, we have tried to give examples of successful practice from all over the range of chemistry teaching. We are fully aware of some topics that could be placed into more chapters. All chapters are very closely related to each other and one would not exist without the other.

2.1 Successful chemistry contests designed for increase of pupils'/students' motivation

There are many contests and projects seeking gifted and talented pupils and students (see also 2.2). And there are many pupils and students who achieved great results in these competitions and projects. One of these contests is described in an article named "The High School Science Talents". It deals with excellent results of four high school students who succeeded in national and international scientific competitions (Expo Science 2012 AMAVET, Professional activity of students etc.) After that some of them participated in students' activities in the USA and Russia. The winners of the competitions currently study chemistry at universities and further develop their interests and talent. [2] A review of this article was uploaded on the CIAAN project portal.

Many more science contests are organized in the Czech Republic. Some of them will be described:

- The Young Chemist contest

Nice example of a national contest could be a national chemical competition named Young Chemist, organized by University Pardubice. The contest is designed for elementary school pupils interested in chemistry. The competition was attended by 5,000 pupils in 2013. The first part of the contest is a test and written assignment. Successful solvers continue in the second part of the contest in labs and only the best of



them continue in the national part. The best solvers of the third part were rewarded (a certificate of merit and material rewards) and national title of champion. [3]

- The Chemistry Olympics

Primary and secondary school pupils/students can participate in international Chemistry Olympics. The idea of the International Chemistry Olympiad was developed in the former Czechoslovakia in 1968. It was designed with the aim to increase the number of international contacts and the exchange of information between nations. The 45th International Chemistry Olympiad was held at Moscow State University on 15 - 24th July 2013. The Czech team won four medals there - three silver and one bronze. [4]

- Other contests

There are organized many other successful contests; one of them is "Life and Chemistry". Aim of this competition was to raise awareness of pupils, parents and the public in the field of chemistry and show the chemistry in a funny way. [5]

ICT Prague organizes a photographic competition named "Chemistry Is Cool". The aim of the contest is to find the best photo with chemical topic as well as to find the interest in chemistry [6]. Widely known is also a contest called "High school science activity" aimed at secondary school students who prepare scientific projects, individual or collective, in any of 18 fields including chemistry. They have to defend their project before the committee. Successful students can continue in international competitions. [7]

2.2 Successful teachers

Number of young science teachers is lowering and the teaching staff is getting older (it is the fourth oldest of the twenty-seven European Union countries). Offices and schools are trying to break this trend. In this report, we have chosen one of many successful teachers and one of many successful projects designed for teachers.

- Chemistry Teachers Inventions Fair

The fair is organized annually at high school in Tábor. Teachers themselves take part demonstrating their experiments they use when teaching. That ways they inspire each other. We consider all the participating teachers as an example of successful experience because they are motivated for lifelong chemistry activities to extend their skills and to improve their teaching of chemistry. The fair has been described in article named "Chemistry Teachers Inventions Fair" published in the Comenius Journal [8] (see also 2.4); the review is available on the CIAAN project portal.

- The Golden Amos (Comenius)

The Golden Amos is a contest designed for teachers and their pupils or students. Children vote for the best teacher. The mission is to popularize especially teachers, who, according to the assessment of children, contribute significantly to shaping the quality of relationships between educators and children. As the best teacher of the Czech Republic in 2012/2013 was elected Ms. Růžena Hlůšková from the elementary school in Kunovice who is a chemistry teacher. [9]

2.3 Successful projects and portals

There are many projects focused on popularization of chemistry between students and the general public. Some of the projects are supported by Ministry of Education, Youth and Sports or by universities and colleges. Others are funded by chemical companies and private bodies.

- The Talnet project

This successful project is described in an article named "Talnet - A Project for Curious Youth" by Lucie Kettnerová, published on the iForum portal of the Charles University in Prague. [10] The author describes the project designed for talented pupils, offering various activities, e.g. lectures, summer camps, international meetings, connection with experts. The main activity of the project is to search young people interested in natural sciences and engineering and to increase their interest. Talnet offers activities for those interested in



science, technology and mathematics. This program is opened to every pupil, there is no pre-selection, nor are there any age restrictions. Activities' difficulty level corresponds to high school students with above average interest in the field. The review of the article has been uploaded on the project portal.

- iForum – a portal of the Charles University.

The portal informs about current events at the university. It is focused on students but there is a lot of information for general public too. Its aim is to attract young people to science. For example, section named “Science at the Charles University” shows science topics in an attractive way. [11]

- Débrouillards club

A nice example of good practice is the Débrouillards club. It is a movement that came to us from Canada and it is focused on after-school science activities. There are many Débrouillards clubs in the Czech Republic. One small special school joined the Débrouillards as a first special school. Children with study disabilities are inquisitive and interested in the experiments too. They focus on the activity itself, they do not seek answers on scientific questions, they do not solve the chemical formulas. This school overcame the barriers and chemistry is taught there as well. The activity is described in article named “Experiments as Elsewhere, Just a Little Easier (by Dr. Radmil Švancar). [12] This article was published in The Teachers' journal (see also 2.4) and the review of it has been uploaded on the CIAAN project portal.

- The Czech Chemistry portal

The Czech Chemistry portal is striving to increase students' motivation. The main aim of this portal is to inform students about new developments in chemistry. It is designed for primary school pupils as well as for secondary school and university students and graduates. The portal also provides online counseling, which eases establishing new contacts between students and professionals. [13]

- The STEP project

Institute of Chemical Technology Prague organizes a project called “STEP” to popularize science, research and development and their results. It attempts to increase primary and secondary school students' motivation to study technical and natural sciences, and subsequently to be interested in work in the field of R&D. The project STEP wants to communicate science and technology to the target groups in understandable way and to develop cooperation among elementary and secondary schools across the Czech Republic. This project is described in an article named “STEP – Step towards the Popularization of Research and Technology” (by Dr. Hana Bartková and Jitka Svatošová) which is uploaded on the CIAAN project portal. [14]

- Science for you

The Academy of Sciences of the Czech Republic offers a project named Science for you. The project popularizes researches in a comprehensible form, organizes excursions and science festivals for students and the general public. [15]

2.4 Successful journals and books

- The Comenius Journal (Komenský)

The journal was founded in 1873, now it has been the oldest pedagogical journal. It presents papers, experiences and ideas, reports, reviews of books and a number of other insights focused on education from the Czech Republic and from abroad. [16]

- Teachers' journal

The Teachers' journal is the most widely used weekly magazine for teachers. It informs about current events in education. The magazine has 32 colored pages full of interviews, analyses, reports, commentaries, expert advice, counseling and information from the Czech Republic and from abroad. It is based on 130 years of tradition. [17]

- Chemistry textbooks



There is no ample choice of quality and modern chemistry textbooks in the Czech Republic. Pupils and students often learn from outdated textbooks that do not correspond with current knowledge. We would like to mention two successful textbooks: Chemistry for 8th grade of primary school by Škoda and Doulík. [18] It is a modern textbook that works with whiteboards and other ICT technologies. It was published in 2006 and nowadays it belongs to the latest chemistry textbooks in the Czech Republic. The textbook was awarded a gold medal as the best textbook for elementary schools in Europe at the Book Fair in Frankfurt, 2008. The second example of a successful textbook is Chemistry for high schools by Honza and Mareček [19]. These are probably the most used chemistry textbooks.

2.5. Successful experience of the Project Chemistry Is All around Us - Network in the Czech Republic

We have managed to establish cooperation with new organizations and schools during the last year. We consider it as a great success.

New associated national partners:

- Technical Museum in Prague, where the Department of Museum Pedagogy prepares illustrative and interactive educational programs for basic and secondary schools.
- Otevíráme, o.s. ("We are opening") – Project Science Café. It is a successful concept of science popularization based on meeting of scientists and public at informal places of cafés. It is currently held in more than 10 cities/towns of the Czech Republic.
- The Czech Chemistry portal organized by University of Pardubice - a club for children and youth (Citizens Association)
- Q-club Příbram is a club for children and youth (Citizens Association). Important are the most all-year clubs, e.g. in IT, multimedia, electrotechnics, astronomy etc.
- Webchemie is a web portal to support chemistry education. The sites are dedicated mostly to chemistry teachers but primary and secondary school students can also find interesting information there. The portal contains namely teaching and learning resources, articles, animations, tests and competitions.

New associated school:

- Lauder school, Prague.

3 Conclusions

Science teachers and researchers as well as their results are very good role models for the youth. Pupils/students may begin their science career through the competitions and projects. Pupils/students and their teachers can meet scientists and experts there and get first contact with real science.

There are many examples of successful experience in the Czech Republic but media and society do not care about that enough and many students do not even know about that. It is very important to put more emphasis on these successful experiences; this could help to motivate students to be more interested in science subjects including chemistry. The project Chemistry Is All around Us - Network aims to promote this cooperation through new contacts and associated partners, schools and teachers.

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