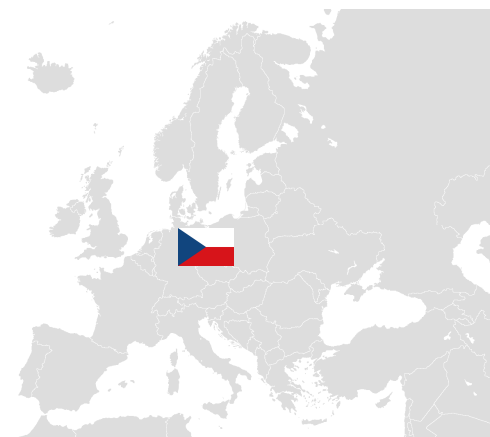


Chemistry Teachers' Training in Czech Republic



TRAINING OF CHEMISTRY TEACHERS` IN THE CZECH REPUBLIC

HOW CZECH INSTITUTIONS OVERCOME THE PROBLEMS WITH LIFELONG LEARNING OF CHEMISTRY TEACHERS

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ABSTRACT

This report is focuses on the theme of lifelong education of chemistry teachers in the Czech Republic. The motivation of students to learn chemistry is low, which is closely related to the approach to lifelong education of teachers. Individual problems and achievements in this matter and even the process of cooperation with the Chemistry is all around us-network project alone are discussed in this work.

This report descirbes the system of undergraduate preparation of teachers and deals with problems. It monitors the directions that contribute on increasing the competence of students during the preparation for job. It covers the possibilities and various projecs focused on improving current situation. In the Czech Republic, the need of change in preparation of future teachers has been discussed for many yearls. These changes are, however, facing many obstacles.

Futhermore, the report focusses on the approach of teachers to lifelong education after succesful graduation. Various directions and options (courses, workshops, summer schools, online education) developing teachers' extensive skills (which are important for more effectivte chemistry teaching in general, but even the new technologies area, language skills etc.) are discussed. It provides best practice examples. For better understanding of the situation, it is necessary to ephasize that education after achieving master's degree is not compulsory for teachers. The teachers feel too busy (time and job-wise) and they also don't have sufficient motivation for self-education.

After finding the opinion of teachers themselves, a brief questionnaire was developt. It was focused especially on teachers' personal view on usefulness and availability of acitivities for teachers, what achievements and difficulties in lifelong education did they experience and what would they like to change in practice. The results of questionnaire are discussed in the report.

1. INTRODUCTION TO THE NATIONAL SITUATION

Motivation of students to study chemistry is low. Therefore, the project Chemistry Is All Around Network (CIAAN) gives an important support to all stakeholders (students, teachers and professionals) along with many other projects and efforts currently ongoing in the Czech Republic. Czech education is in a complex situation. Framework educational programs were recently formed for elementary and high schools. Every school has to create its individual School educational program based on Framework educational program. Also from 2011 every high school student has to take Final (leaving) exams. These Final state examinations have been prepared since 1999 and the situation about them is still very confusing and unclear for many teachers and students as well as many teachers admit to be much more busy preparing Final state examinations. There is a debate of implementing comparative testing for elementary school students. In 2012 and 2013 provisional general nationwide examinations were conducted and from 2014 all elementary school students should be tested mandatory. Despite these great efforts to improve the educational system, the OECD report in 2012 criticised the level of the educational system in the Czech Republic, saying "The decline of students' abilities is very serious and it is one of the most serious declines among developed countries" [1]. Previously acknowledged quality of the Czech system thus has its problems. Ministry of Education, Youth and Sports is looking for ways to remedy the situation. One way is to reform the preparation of future teachers. It is required to graduate from college to obtain the approbation of the teacher. The level of individual colleges can vary significantly. After successful graduation from college the teachers are not obligated to attend continuing



education courses. Also the motivation of teachers to study longer than necessary is often low. However, this certainly has a significant influence on the quality of teaching chemistry on elementary and high schools.

2. THE SITUATION OF TEACHERS' ATTITUDES TO EDUCATION

2.1 PRE-GRADUATE TRAINING OF FUTURE CHEMISTRY TEACHERS

The preparation of teachers starts even before taking their final exams on high school. Here comes the first motivation to study natural sciences. Students also have an opportunity to observe teachers as role models. For future teachers, the most common way of study is to attend high school and then The College of Education with a focus on chemistry and another different (second) field. Instead of a high school student may choose a vocational school with a chemical emphasis, or vocational school of education or another vocational school, so students don't have to decide to study chemistry on elementary school. They can change their mind after graduation from high school, because Czech educational system is transmissive.

A specific feature of education in the Czech Republic is higher professional school (based on ISCED 4), which are studied after graduation, but do not lead to a university degree [2]. Such schools tend to focus primarily on the practical application of knowledge. Students of vocational chemistry schools have more laboratory lessons than the others. Those students don't reach a university degree, although they often have more experience than college students.

A requirement for obtaining teaching certification is reaching the master university degree (ISCED 5), focusing on the fields of study and education. The directors of both elementary and high schools talk about a lack of high quality chemistry teachers. "The situation is really serious especially in physics, chemistry and maths. Due to low number of learners and high costs are these subjects teetering on the edge of sustainability. Number of graduates teaching these subjects at the Master's level decreased by about 50 percent in the last ten years and threatens further drop," says the Students' Union spokesman Jiří Kohout. This confirms the words of Václav Víška, Vice Dean of the Faculty of Education, University of Hradec Králové. He estimates that the interest in teaching physics and chemistry halved over the last ten years. "Teaching can be chosen by seniors who had worse results at school, which leads to the fact that many of them cannot handle to study hard. In addition, many graduates are not directed to go teaching, because such education will sooner or later find them work in private companies for double pay. The management of elementary and high schools finds it difficult to get maths, chemistry and physics cantors already. This will be a serious problem to the future," warns the President of the Association of Directors of high schools Jiří Kuhn. Teaching staff of the Czech Republic is the fourth oldest of the twenty-seven European Union countries. Nearly half of cantors are more than 46 years. [3] Aleš Mareček (author of the popular chemistry textbooks for high schools) states: "I see the cause of the lack of interest of high school students for higher education in science (and engineering disciplines) in the fact that as graduates, they're being underpaid and not given an appropriate social prestige (Except specialists in computer techniques). It's often more laborious and time-consuming to study at schools with a focus on science and technology. Humanities-oriented courses are also cheaper than scientific and technical ones and therefore it's easier to establish various universities, often of questionable quality that makes it very easy to get a diploma." [4]

The preparation of students-future teachers is not uniform in the Czech Republic not only in the field of chemistry. Creating a standard teaching profession is a special project of the Ministry of Education, Youth and Sports (MŠMT). "The main goal is to increase the level of education provided at all schools in the Czech Republic. One of the necessary steps to achieve this goal is to intensify the professional qualifications of teachers. It is also important to determine priorities, the achievement of which is the completion of the project expected. In fact, the Ministry plans to establish a desired quality of teaching profession. Increasing the already well-established standards would also help to improve the quality of education at elementary and high schools." [5] According to the Association of teaching profession is needed to establish the quality standard of the teaching profession, which would guarantee a good and comparable level of competence of graduates (future teachers). Teacher quality and professional standard came into the spotlight in the National Programme for the Development of education in the Czech Republic (so called White Paper). In this paper, the quality teachers are considered as the key players in the transformation of schools. The establishment of standard has also its opponents. They criticize the fact that not all areas and competences can be clearly defined and determined. Also, they criticize formalism or bureaucratic burden for teachers. However, the



standard should clearly be an instrument of support for teachers, not an instrument for checking. This process is very complex and takes a long time as well as establishing standards for basic education (Framework educational programs). Therefore, the teaching profession standard is still at the discussion. State final examinations and comparison of school children and their schools is now a major issue.

Chemistry teachers should have the Master degree, but the lack of teachers in some areas in the Czech Republic forces headmasters to accept unqualified teachers.

- The organization of universities and funding sources

Colleges are: public, state, or private. The list is available on the portal of the Ministry of Education (<http://www.msmt.cz/vzdelavani/vysoke-skolstvi/prehled-vysokych-skol>). Private colleges must be authorised by the Ministry of Education. These universities are mainly financed from their own resources, but they can get subsidies from state. State colleges are military or police. They are managed directly by the relevant ministries (interior and defense) and do not have legal personality and state agencies. The university autonomy is limited here. However, future chemistry teachers are usually not prepared at state universities. The most common type of college chosen by students is a public college, rarely a private college. Public schools are established and abolished by law and funded mainly by government subsidies. Resources are provided to universities by Act No. 111/1998 Coll., On universities and amending other laws, as amended, in accordance with Act No. 218/2000 Coll., On budgetary rules and amending certain related acts, as amended. Furthermore, when determining the general conditions, the law relies on the Decree No. 52/2008 Coll. and Act No. 320/2001 Coll., on financial control in public administration. [7]

The state budget for universities is going through changes. It concerns the planned reform of education. Actively discussed fees for students studying on non-private schools should be dealt with other law, however, the reform counts with them as well. Due to protests of academics in the past, the reforms were not approved. The purpose of the reform is to stop the decline in the quality of education at universities and inefficient allocation of money. Czech school system is going through major changes in this area.

- Teaching methods

Methods of preparing teachers vary a lot. The Science faculty students have prioritized mainly the professional courses in the field of natural sciences and laboratory work. The students of Faculties of Education tend to have more practice in schools. If students attend schools remotely, they have to use computer and the internet very often. They also communicate with teachers online. For all types of universities is a predominant method of teaching a verbal method (lecture notes, lectures, online texts), a method of visual demonstration (experiments, the performance of school supplies, etc.), skills practice (laboratories, field trips, practice in schools), or methods of discussion. Lectures are usually in the form of frontal teaching and in laboratories, there is preferred the work of individuals. The ratio of theoretical and practical training varies significantly according to the type of school.

The issue of new teaching methods was followed up by the team of Dr. Nataša Mazáčová. in 2007-2009: they see benefits in preparing future chemistry teachers in a way to understand how contemporary schools and students look like. Basic principles of the development of didactic thinking of future teachers are the trends that lead to a completely new orientation of the current school. This is essentially a rejection of unilateral orientation on the curriculum in its encyclopaedic and scientific concept, overcoming unilaterally rationalist conception of the educational process, overcoming the fragmentation of the knowledge of the curriculum, the concept of passive learner, or authoritarian school climate, etc. In the process of preparing future teachers should teachers guide students to intensively think about not only what do students learn, but also how do they learn. Therefore, the basis is a good pedagogical knowledge both theoretical and practical that allows the teacher to solve a variety of pedagogical situations, learn how to create such didactic situations that encourage active interaction between students and the curriculum.

The Association of teaching profession set the Ten Commandments to restore the quality of education. As one of the requirements indicate the need to improve the quality of future teachers in this way: The teacher must be an expert in his profession with an adequate confidence, strength of personality, who can reflect his work and develop himself in it and also share it with colleagues. He should be able to sensitively perceive differences of students, encourage their talent and confidence, and motivate them to learn. They created a graphical representation of the idea of Concept of education leading to quality (see Figure 1). There are three different goals: the quality of curriculum, educators and educational institutions. Ways to achieve the



objectives represent a selection of appropriately named objectives, the implementation of objectives (search for effective forms), assessment of goals and motivation to achieve objectives (certification). [8]

Conception of education leading to quality:

QUALITY OF EDUCATION					
QUALITY OF CURRICULUM	↑	QUALITY OF EDUCATORS	↑	QUALITY OF EDUCATIONAL INSTITUTIONS	Objective
Certification of education Pupils` motivation		Certification of educators Teachers` motivation		Certification of educational institutions Motivation of educational institutions	WHY Motivation to achieve the objectives
Assessment of curriculum		Assessment of pedagogic workers	Periodical assessment of school directors	Self-assessment of a school Outer assessment of a school	EXTENT AND QUALITY Assessment of the objectives
Effective forms and methods of education		Quality pre-graduate preparation of teachers	Quality LLL	School educational programmes or accreditation programmes	BY WHAT AND HOW Realization of the objectives
Criteria of quality and meaningful education		Criteria of quality teacher – Quality standard of teacher`s work	Criteria of quality school director	Criteria of quality school	CONTENT Denomination of content of the objectives

Fig. 1: Program for Quality in Education [8] (translation by the authors of the report)

- Leaving exams and supervision of prospective teachers

The completion of bachelor study program is given by obtaining credits, that are specified in a study plan (previously approved by an accreditation board) and final bachelor state exam, which consists of a bachelor project defense and an exam of the given field problematics.

After completion of the bachelor program and in case of passing the entrance exams, a student can continue in a master program. A master's degree is obtained the same way.

Through bachelor and master theses, a student proves an ability of creative and independent work in a completed field of study.

The total length of both programs is usually five years in total, (three years of the bachelor program and two years of the master program). Some universities do not have such a division into two programs, yet, the study program is completed by a master's state exam and a master's thesis defense.

- Fields of teachers' pregradual preparation

The preparation of prospective teachers is a process in which students' competences get extended in many areas. For simplification and better understanding of various ways of teacher's preparation, these competences can be divided into five areas.[9]:

1. professional education in the subjects of teaching certification
2. generally cultural university basics
3. subject methodology
4. educational - psychological competences
5. experience

- Various ways of teachers' pregradual preparation

There are various ways how to become a certified chemistry teacher during studies at a university. As we have earlier suggested, the system of teachers' preparation is not unified and might seem to be very complicated. Therefore, here is a brief list of various ways how to obtain a teaching certification.

Option 1

Bachelor's degree: Educational-psychological preparation, inspection of classes, science field basics

Master's degree: Builds on the science field basics and develops it. The emphasis is put on teachers' preparation.

Option 2

Bachelor's degree: Only science focus in one or two fields, teaching focus only as an optional subject.

Master's degree: Follows the bachelor's degree, escalates the science field focus, inclusion of teaching focus

Option 3

Bachelor's degree: only of non-teaching character, focused only on the science

Master's degree: follows the bachelor's degree, focused on teaching subjects and teaching experience

Option 4

It is very different from the previous ones. It is dedicated to chemistry school graduates, who decide (during or after completion of the study) to become a chemistry teacher on top of their study program. Therefore firstly there is a non teaching study program terminated by master's exam. It is followed by further bachelor program, focused on chemistry methodology and pedagogical-psychological basics.

Option 5

This is very untypical way, but we demonstrate it to illustrate nonstandard of pregradual preparation system. Teachers at vocational schools after finishing their secondary chemical school can study bachelor program, where they obtain teaching basics and expand their professional knowledge. They don't follow on master's program and they became so called masters for their apprentices at vocational schools.

These five options are the same in many aspects; on the other hand they vary considerably in many other aspects. An attempt is made to find an intersection of the systems and to find a proposal which could be applicable in every school.

- The focus and innovative approach

The focus has been discussed in the previous chapter. It has been indicated, that the education is going through changes and reforms. The efforts of innovative methods are visible. The Project "Innovation of professional preparation of prospective chemistry teachers" at Palacký University in Olomouc, can serve as an example. This project has been co-financed by the European social fund and the state budget of the Czech Republic. The aim is to allow prospective chemistry teachers to be in a close contact with pupils at primary and secondary schools, through management of students' projects directly in chemistry lessons, tutoring laboratory lessons, organizing chemistry olympiad at schools and excursions to laboratories for pupils, chemistry consultations for talented secondary school pupils, preparation of natural science competitions and popularizing events.

The focus on preparation of prospective chemistry teachers has become a priority even to the International Year of Chemistry, where international student's conference Project teaching in chemistry and related subjects by Faculty of Education, Charles University (Chemistry and Chemistry methodology department) took place.

- The use of ICT

A majority of people in the Czech Republic owns a computer and considers it as a part of their lives. Education sphere tries to adjust to this tendency. Unfortunately, most of the schools are a step (or sometimes several steps) behind. The lack of finances is the main reason, in addition many teachers are unprepared. The requirement for successful implementation of ICT in education is also the teachers' ability to use these tools adequately. The current situation has been very critical at some points. Teachers' way of thinking and the way they prepare their lessons is usually very conservative to changes, we can positively say, that this exactly will be the most difficult task of the entire reform. There is also an extreme risk, that the technologies will reach the schools even before the teachers reach appropriate education in this field. Then it may happen, that the technology will be used in an inappropriated way and the whole reform will be unsuccessful, or even contraproductive. The long-term solution is the appropriate teachers' preparation. Today's graduates can safely operate the basic user tools on a computer, nevertheless, this knowledge without professional guidance is not sufficient.

- The strategy of education maintenance with science progress, cooperation with experts

To keep the science progress in education of prospective teachers is guaranteed by the fact, that the education occurs at universities. Universities are the centers of science and progress and at the same time they guarantee the scientific approach. During their pregradual preparation, students have compulsory subjects in the field of Chemistry and Methodology. Students mainly meet the experts here. Experts guide their students and are open to a discussion. After graduation, the relationship with a university changes.

An expert group in Chemistry education is a very beneficial activity in this area. The topics of this group are: Innovation and updates of the content of the Chemistry curriculum at primary and secondary schools and at university preparation of prospective teachers, modernization of Chemistry teaching at all school levels, in a view of a curriculum's presentation, for example the use of Information and Communication Technologies in classrooms.

This group also organizes workshops to educate teachers from primary and secondary schools, lectures, but also a combined form of a postgradual study program. The aim of the group is to help the development of Chemistry methodology as a scientific field and a college subject, and cooperation among universities in preparation and implementation newly accredited study programs of Chemistry teaching at Faculty of Science and Faculty of Education, in all three levels, bachelor's, master's and doctoral. [11]



For students, the group also organizes conferences, student science competitions, workshops and other events. For instance, it helped to prepare an international students' conference Project teaching in chemistry which occurred during the International year of Chemistry. Also, it took part in managing a conference called Chemistry is life which took place at Faculty of Chemistry at Brno University of Technology. A planned Conference at the occasion of the 100th anniversary of the Nielse Bohr's atom model (University of Pardubice) is also worth mentioning.

2.2 LIFELONG TEACHERS' EDUCATION

The Teachers' Profession Association comments the lifelong education of teachers as following: "A High quality teacher is the one who is constantly improving and developing. Let's control the quality of an accredited education, let's also use the capacity and expertise of universities that prepare prospective teachers for further education of current teachers. Let's set up a career system, which gives an advantage to the teachers who continue in a self-development. Let's allow the best teachers from all levels of education to have an influence on a preparation of prospective teachers through a leading practice or own lessons at a university"[2]. Similarly to the lack of a system in pregradual preparation, there is no unified system of a lifelong education of graduated teachers. During their studies, students are being kept reminded by their teachers about the necessity of a lifelong education. However, an adequate motivation is missing for many of them. Firstly this progression itself is demanding. Secondary, the salary rate is low, the courses of lifelong education are not very popular, even if the reputation of the individual schools might improve. The courses vary in many aspects, but they also have plenty in common. It is necessary for the courses to have a certification from Ministry of Education, Youth and Sports, so the people, who leave the course, could obtain a certificate of attendance to prove an improvement of their competencies. The courses are not compulsory, however some headmasters motivate their teachers to attend them, so the schools would improve their reputation. The trainings are mandatory for teachers who work with students handling with dangerous and toxic substance. Also trainings about a new leaving exam are mandatory.

a) Teacher trainings in Chemistry

- News in Science: Open science is a training, that interconnects the world of chemistry and teaching, presents new trends in science and also searches ways how to motivate students.
<http://www.otevrena-veda.cz/kurzy-pro-pedagogy/ov-kurzy-pro-pedagogy.html>;
- News in legislation how to operate with chemicals;
- Work safety for teachers and students (public health protection law etc.)
- Searching of new ways of quality improvement of prospective chemistry teachers
<http://ucitelchemie.upol.cz/> right now is taking place at Palacky University in Olomouc (1.1. 2011 – 31.12. 2013)

b) Trainings in pedagogical competences

- New methodology in education (september 2012) the project Čtyřlístek in Liberec district
<http://www.portal-ctyrlistek.cz/cs/fotogalerie/skoleni-ucitelu-chemie.html>;
- According to a new leaving exam, the Center for ensuring the results in education and National institute for further education organize a training. A new leaving exam is a highly discussed topic and the main reason why Czech teachers are so busy nowadays.
<http://www.novamaturita.cz/vzdelavani-pedagogu-1404033799.html>;
- Lessons of Modern Science within the project STEP (Step to popularize science and research). During a demonstrational lesson, new ways of a lesson management are presented to teachers, as well as to students.

c) Trainings in new technologies

New technologies are an inseparable part of teacher's profession. They are very popular for students and they increase their motivation not only in chemistry but also in many other fields. Nowadays, so called interactive boards and virtual excursions are very popular. Projections of chemical experiments are very common. Even laboratory techniques are used. To use these methods, the teacher has to be able to master them at least on the basic level. There are plenty of courses for teachers in this area. The problem still remains at funding and



availability of technologies at schools. Not all schools have enough computers, some of them are often out of date. In an annual report, the Czech school inspection states, that in 2011/2012 period, 73% of schools did not use the modern technologies at all. [12]

Various courses, that were held in the Czech Republic dealt with topics as: How to work with an interactive board, How to create a presentation, How to communicate online, Videoweb at chemistry teacher's work, etc. The teachers' ability to operate information and communication technologies facilitates their contact to online portals and information to teachers. Therefore, they can stay informed about current news in education. One good example is a methodology portal rvp.cz, which offers a methodology help for teachers and allows teachers to exchange their experience. The most common educational informational system is portal.skolaonline.cz. Also www.ceskaskola.cz is an interesting source.

d) Trainings in language skills

Czech chemistry teachers generally lack language skills of English. That is a barrier that keeps them from a cooperation in international projects and searching for new information in chemistry on international databases. There is a plenty of language courses in our country. Courses oriented on chemists are also available.

e) Conferences oriented on complex teacher's development

For example Fare of Ideas of Chemistry Teachers - a professional conference for chemistry teachers.

f) Books for teachers

Teacher's first steps (Podlahová) - Instructions for graduates, how to orientate themselves at a new school, how to have an authority, how to fit in the staff and how to make friendly environment in a classroom. Necessary tool for effective lesson management even in chemistry.

Educational experiment in Chemistry (Karel Holada) - the book originated during the UN Year of Chemistry 2011 at Chemistry department of Charles University. It is suitable for prospective teachers as well as current teachers.

3. CURRENT STATE OF SCIENCE TEACHER EDUCATION

Current state of undergraduate education and lifelong learning process of teachers has been already discussed above. In order to determine the views and opinions of teachers we compiled a questionnaire. It was distributed to attendants of 27th Summer Schools for chemistry teachers called Chemistry for Life. Summer School was organized by the Institute of Chemical Technology in Prague and was held on August 27th 2013 in National Technical Library in Prague.

The aim of the survey was to determine:

- whether teachers consider their education at university sufficient;
- if they believe lifelong learning (LLL) is important (meaningful) and if LLL is accessible for them;
- if they feel the school management has been supporting them in LLL;
- problems that teachers currently face and that make it difficult for them to work and to teach effectively;
- what they would like to be changed.

There was distributed number of 150 questionnaires, 78 of them were returned completed. Respondents were primary and secondary school chemistry teachers from all over the Czech Republic. For a thorough examination of the current state it would be appropriate to undertake more extensive investigation, but for time, personnel and financial reasons it was not applicable within this project. Nevertheless, we consider the extent used as an interesting probe that showed us a lot of interesting ideas and thought-provoking comments of the teachers, that can be further discussed.

With the aim to describe the main results of the survey clearly, the order of questions asked in the questionnaire will be further followed.

• Question 1 and 2: What is your highest level of education? Please indicate length of your teaching practice in years.



All teachers without exception have achieved university education. The average number of years of practice was 20 years. The most common number of years of practice was 20 years, as well as 13 years and 30 years. 5 teachers (6.4 %) stated 35 years of experience (fig.2). The chart does not show option 0 to five years of the practice, because there was no teacher-respondent among participants of the Summer School. There was only 1 teacher "beginner" with only 5 years of teaching practice. Participating respondents - chemistry teachers were certainly very experienced professionals. However, the average length of their teaching practice, which was rather high, leads to a question if there are enough teachers for the next generation of pupils. The aging of the teaching staff in Czech Republic is generally recognized current problem, which is reflected in the results of our probe.

Teaching practice of chemistry teachers

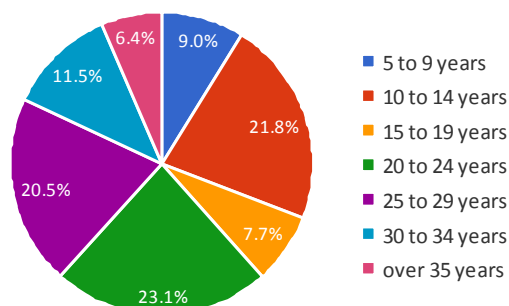


Fig. 2: Teaching practice of chemistry teachers participating in the survey (in years).

• Question 3: Do you think the university provided you with sufficient knowledge and skills to carry out the teaching profession?

YES answered 49 teachers (62.8 %), NO answered 26 teachers (33.3 %), the rest did not know. Some respondents added that they gained the needed skills primarily during their practice and expressed the need for lifelong learning for continual renewal of their knowledge. Some of them also said that due to the long time interval after their leaving of the university, they are not sure about the answer.

Did the university provided you with sufficient knowledge and skills?

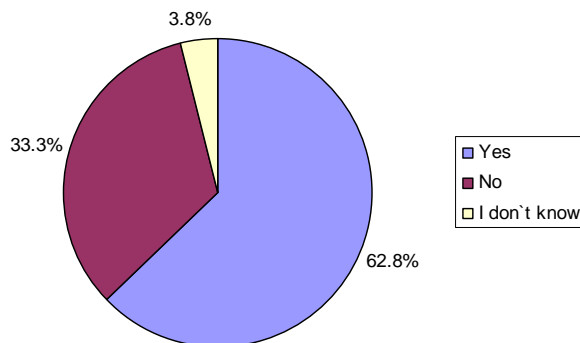


Fig. 3: Responses to the question whether the university provided the teachers with sufficient knowledge and skills to carry out the teaching profession.

• Question 4: Are you motivated to attend conferences, workshops, meetings and other activities organized for chemistry teachers?

67 teachers (85.9 %) felt motivated, 8 teachers (10.3%) weren't motivated and the rest stated they don't know. Motivation seems to be therefore sufficient (see Fig 4).

• Question 5: Does the school management support your effort for extension of your competencies?

Teacher's motivation for LLL seems to be closely related to the support of extension of teacher's competencies that the teacher feels from the school management. Most of the respondents felt motivated while well supported. Those respondents who felt lack of support from management often were little motivated for LLL (see Fig 4).

• Question 6: Do you consider trainings for teachers useful?

75 teachers (96.2 %) said they consider trainings useful. Teachers however at the same time pointed out that only high-quality trainings are useful. This suggests that some of the organized trainings may have worse quality. There could be useful a further discussion with the aim to point out gaps in training sessions. Such a discussion would be beneficial for the organizers of trainings, but was not feasible in our probe. It would be interesting to open and work on this topic in the future again.

There was also discussed an opinion in the probe, that some training sessions and school projects are used rather as a source of finances, than as a mean to increase motivation for extension of teachers competencies. It reflects current situation where teachers do not have sufficient financial resources for quality teaching of their students. Teachers can't be blamed for the described situation, but it is necessary to realize the problem.

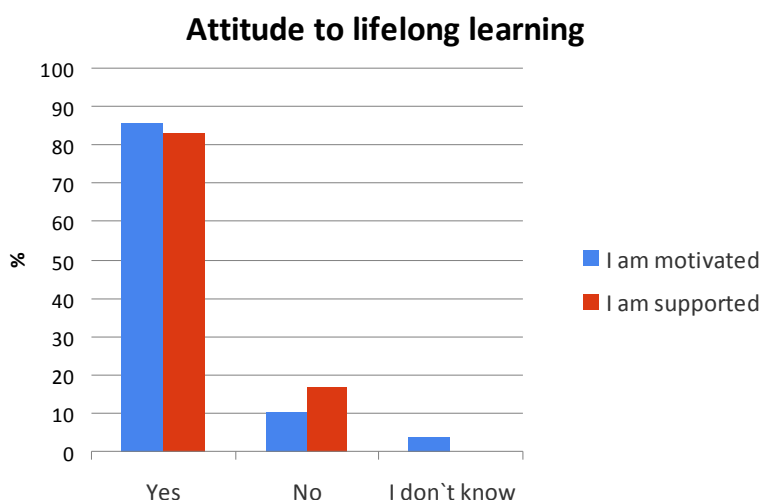


Fig. 4: Teachers motivation for LLL and support provided by management of their schools.

• Question 7: Do you have enough information about teachers trainings offered?

Sufficient information had 58 teachers (74.4 %). Some teachers add that information is sometimes too much. There is the question remaining whether the teachers who did not have got enough information has really not got it, or have not actively sought it. This is again closely related to motivation to lifelong learning and support from the school management. Again, it would be interesting to discuss further the situation with the teachers in the future.

- Questions 8 and 9: Are trainings offered available for you? If the trainings are not available for you, indicate the reason:

Trainings were available for 53 teachers (73.1 %).

This situation can be considered as gratifying. Still there are problems with availability of trainings for a whole quarter of teachers asked, and that should be solved. As main problems were stated distance and time-consuming commuting. Trainings were mostly held in the capital city and in large cities. For small villages teachers are therefore unattainable.

The most common obstacle, were stated once again finances. Financial problems were with the travel reimbursement, reimbursement of the course, as well as lack of money for substitute teachers. Another common problem was lack of time. Time spent on training consumes teaching time and lead to slippages in teaching plans.

- Question 10: What training topics are (would be) most interesting for you?

Topics of interest were numerous and varied a lot. The most common topics of interest were chemistry of everyday life, the latest news in the development of chemistry, chemistry connection with the practice, chemical experiments (safe, up-to-date, modern, attractive). Organization of chemical experiments is a very challenging task. Legislation, time and financial problems lead teachers to explore new paths.

Teachers also expressed concern about the topics from the field of food and nutrition, pharmaceuticals, genetics, nanotechnology, didactics in chemistry etc.

- Question 11: What is the biggest problem in your practice?

In responding to this question the teachers gave broad reports of lot of problems in practice. It is clear that the current situation is not satisfactory. The responses showed following major and fundamental problems:

Lack of funding and the resulting problems such as poorly equipped laboratories, old and out-of-date equipped classrooms, lack of funds for chemicals, low wages, unavailability of materials and equipment and general equipment.

Teachers also commented the fact that declining number of students in general leads to the need to accept less motivated students in secondary schools. The reason is again finance. But this causes decrease of the quality level of the class and also decrease of students' motivation to perform better. Decreasing quality-level of the whole class then relates with the need of school management to simplify curriculum and reducing requirements for memorizing formulas and coping calculations. However, this leads to even greater quality-level drop. Students' moral approach to learning is according to some teachers problematic as well. Focus of pupils is directed mainly to achieve personal gain while thinking how to get around curriculum fraud.

Often recurrent theme was also lack of time - low hours allocated to teaching chemistry, and lack of space to practice the subject matter and chemical experiments. Teachers must often carry out many side tasks (e.g. supervision in the school canteen) and then they can't pay enough attention and focus on the main task - quality teaching.

Teachers also see problems in communicating with parents who have unrealistic expectations and demands. Many teachers find the educational programs poorly made and consider science subjects not set into interrelationship, which leads to detachment from reality and unawareness of problems as a whole. The level of state graduation and their concept is according to the results of the questionnaire also unsatisfactory.

Very interesting view has been expressed by one teacher who summarized problems as follows: *"The status of a teacher in our society is bad - this is the main cause of the most problems. For a teacher who does not feel trust, recognition and support from parents and society it is then far more difficult to get his pupils interested in science and motivate them for the study. Problems are thus not only due to lack of money, time, due to poor communication and others. The problem is in the overall approach to education and chemistry."*

Fear of chemistry in the minds of students decreases motivation and performance.

One of the teachers expressed a very useful remark, which also very concisely outlines the current situation:

"In addition to my profession of a teacher I perform functions such as superintendent, clerk, PC graphic designer, cleaner, leisure time manager, class tutor, culture officer and a guide. Thus I'm somewhat hampered in teaching. Financial motivation is zero. Also, the pressure on the teachers by mentioning the possibility of losing my job is strongly unpleasant."

The questionnaire was anonymous. However, we would like to thank all the participating teachers for honesty and for their perseverance in the effort to motivate their students to chemistry and also for their effort to



broaden and renew their teaching skills and knowledge not only by attending the Summer School for Teachers of Chemistry.

4. RESULTS OF THE PROJECT

Collaboration between teachers and experts in the field of chemistry proceeded also at the workshop of this project where the teachers could get to know new results of some actual scientific research carried out at ICT Prague. There took place communication not only between the project members and the teachers but also between the teachers and the scientists. We would like to emphasise this as a very beneficial result of the workshop.

Following topics were also discussed at the workshop: contemporary state of the educational system, life-long learning of teachers – importance of teachers being informed about current state of science and research, problems with teachers' overload, problems with new leaving examinations ("maturita"), examples of non-traditional teaching methods and procedures. The discussion was abundant. Both the teachers and the experts agree that there is insufficient students' motivation to study chemistry and generally (natural) science and that it is necessary to improve or at least maintain current level of education, which must be connected with change of attitude of most of the population to the profession of a teacher and to education in general.

The materials available on the project portal (teaching resources, publications, conference papers, national and transnational reports) are also useful. It is advantageous that the project portal is not only a guidepost to these resources but it contains also their reviews supplemented with users' comments because quality of the referenced materials is variable. The comments are very brief in some cases because teachers do not like to create them as we will describe below.

The issues of teachers training in the Czech Republic are discussed in the following publications the reviews of which have been posted on the project portal:

- 1) [Methodology of Chemistry Teaching at the Second Level of Basic Schools \(Lower Secondary\) and at Upper Secondary Schools from the Viewpoint of Pedagogical Practice – Proposals for Beginning Teachers](#)
- 2) [Specifics of Chemistry Lessons at Non-Chemical Secondary Vocational Schools](#)
- 3) [Actual Trends in Chemistry Teaching: Past, Present and Perspectives](#)
- 4) [Analysis of Chemistry Lessons Supported by Video Records](#)
- 5) [Possibilities to Create Stereoscopic Materials for Learning Chemistry at High Schools](#)

Besides the workshop, the communication between experts and teachers took place also by means of comments below the links. However, the teachers did not find the comments useful and at personal interviews they reported that by commenting the materials they are more likely not motivated to work for the project. Nevertheless, they find the materials themselves very useful and interesting.

Following conclusions have been deduced from questionnaires assessing the project portal: As the strongest part of the project most of the experts and teachers consider the extensive database of publications and links, contact to various organisations and projects and clarity of the websites. However, the teachers reproached not very attractive graphics and also language barriers. At least, we attempted to partially remove these barriers by translation of the main project websites to Czech language. However, most of the resources remain in English and this may dissuade teachers to use the portal (as discussed above).

The partners and people not involved in the project were mostly captivated by the project which seemed interesting for them. They discussed problems in education of future educators and teachers in service. Our effort to involve teachers in the project often met these problems, namely language barrier (English), lack of time, low motivation for life-long learning and computer skills. To be complete we must mention disputable remuneration for teachers' work. If we compare the average monthly wage/salary in the educational system with the average monthly wage/salary of all employees in the Czech Republic, we can find out that the average monthly wage/salary of the employees in regional education in 1st to 4th trimester reached only 89.7% of the countrywide average [14]. The teachers often feel tired due to high requirements. They are not only chemistry teachers, however, they usually teach another subject (or more); at the same time they possess the role of e.g. class master, custodian of laboratory and equipment, supervisor at corridors during breaks and many others. We have to understand their feelings. However, teachers' collaboration with the project is voluntary. Despite these barriers we managed to join sufficient amount of teachers. At the same time



our effort is focused on motivation of teachers to work for the project and to show them advantages of their collaboration. We had found several schools successfully with which the collaboration is very good. These are the schools employing teachers that like their field and are genuine educators and experts at once. We managed to increase the total number of co-working teachers. At the project start-up 10 teachers from 6 schools and 5 scientific and research experts in the field of chemistry and education in chemistry had been involved. Now we have managed to enrich the network by more teachers from 3 associated schools. Many other teachers and experts contributed via comments below the reviews of materials, papers and publications. We are currently focusing our effort on involving more associated partners from the field of education in chemistry other than schools.

5. CONCLUSIONS

This work deals with the issues of pre-graduate preparation of future teachers of chemistry and life-long learning of teachers who have graduated from university. The actual topics in the field of chemistry teaching, educational curricula, leaving examinations and students' motivation, problems and sculptures of teachers performing their everyday work have been also discussed.

The both pre-service and in-service training of science teachers is not unified in the Czech Republic. There are many ways how to become a chemistry teacher and quality of graduates may be variable. A reform has been applied which attempts to create a standard in order to stop deterioration of results in educational system in this field. Czech educational system has had a good reputation on international level and our effort has to be addressed to it not to lose its reputation.

There are many problems with life-long learning of teachers. A good news is that both pedagogical faculties and the ministry fully realize this aspect and strive to improve it. There exist also organisations and projects dealing deeply with this issue. This is a long-term matter and the projects like this one can help to improve the situation.

Based on a questionnaire investigation prepared by us (78 respondents, participants of Summer school for chemistry teachers), a small research has been accomplished mapping the actual state and opinions of the chemistry teachers. From the answers it was concluded that chemistry teachers are interested in life-long education, they feel support from principalities of their schools, they have enough information about activities in this field and they also consider the trainings accessible. This holds up hopes to improve many problems that have been discussed in the questionnaire. The most relevant insufficiencies were considered: lack of financial resources for teaching, lowering allocation of lessons, decrement of chemical experiments, but also morality and communication with the parents of the pupils.

During the second year of the project, in spite of some problems, we managed to continue with its activities focusing teachers' training at the moment. The database on the project portal has been enriched by new papers. The willingness of some teachers to collaborate is low. On the other hand, we have involved other associated schools, teachers, organizations and projects.

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